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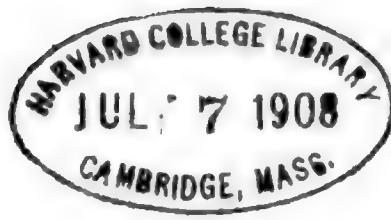
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VIEW OF THE CHICAGO BRIDGE AT NIGHT.



STONE & WEBSTER PUBLIC SERVICE JOURNAL

JULY, 1908

EDITORIAL COMMENT

This might properly be termed the "Anniversary Number" of the Journal, the first issue being that for July, 1907. The first year of a publication is apt to be its trying period. With success comes, perhaps, a larger measure of work, but there is an absence of the perplexing problems incidental to once getting a firm footing. It is most often the case with publications, as with human beings, that the child is father to the man. While the Journal has by no means accomplished all that was in mind in starting it, it has, we trust, displayed a spirit and method indicative of matured qualities, as time goes on, of a commendable character. The aim has been, to change the figure somewhat, to bend the twig in the way the tree should grow. So far as we are able to judge, the Journal has developed a distinct individuality. It is expressive, we think, of principles and policies which already have a wide acceptance, and which are destined to have even a wider. And so far as one of its leading aims is concerned—that of cementing in the closest possible union the different factors of the Stone & Webster organization—it seems to have made very considerable headway. Its literary quality has increased, its subject matter has shown enlarged powers of concentration on the part of the contributors, and in other essential ways it has progressed as fast as could be expected.

The Journal began its existence with no distinct purpose of becoming an illustrated magazine. This, however, is a pictorial age, and it has seemed impossible for us to resist going, to some extent, with the tide. Our purpose is, however, not to print illustrations merely for the sake of illustrations. The present number of the Journal contains a goodly number of pictures, most of which clearly add to the value of the articles which they accompany.

The Financial Situation

The first of July is always a period of retrospection in the financial world. Hence, Mr. A. S. Michener's article in this number, on "The Effect of the Present Business Depression Upon the Earnings of Street Railways," is very timely. The facts which he presents will of course have a peculiar meaning for those interested in street railways; but their importance is by no means confined to this particular class, for Mr. Michener reaches his conclusions with reference to street railways by a process of comparison. He notes, for example, the changes in bank clearings, by months, from October to April; the increase in bank and commercial failures in 1907; the decrease in United States Steel Corporation earnings in the first three months of 1908; the net loss in immigration during the first quarter of the present year; the shrinkage in our various crops in 1907; the change by month, from October, 1907, to April, 1908, of the great car shortage of the steam railroads into a huge surplusage; the conversion of the big gains in railroad gross and net earnings of 1907 to the big losses of 1908; and the continued gains (though on a diminished scale) of both gross and net by street railways. While all these different sets of facts have been presented many times before, they have seldom, if ever, been grouped together in such an interesting and graphic manner.

In a word, Mr. Michener has made it easy for the reader to obtain a comprehensive view of the situation created, or at least introduced, by the panic of last October. Some two months have elapsed since the period up to which his figures have been brought, but the changes in the interval have not been of enough importance to vitiate his facts as a basis for present use with reference to the financial situation. The industrial depression reflected by his data still continues. The comparison which he notes between the oper-



ations of the steam railroads and the street railways is practically unchanged. That is, the latter still hold their own to a considerably better extent than the former. The situation as Mr. Michener saw it in April finds its logical outcome in a reduction of about \$20,000,000 in the July 1 interest and dividend disbursements of the leading corporations of the country, affecting the stockholders of some eighty railroads and industrial enterprises. Sixteen steam railroads have passed their dividends, and ten have made reductions. Of the well-known industrial corporations, twenty-six have omitted their dividends entirely, and twenty-nine have made cuts. In addition to the omission and curtailment of dividends, mention should be made of the fact that there has been a suspension or reduction on about a dozen issues of bonds of corporations that have passed into the hands of receivers.

The financial situation is still too mixed to admit of prophecy. On the one hand, prices, wages and volume of production have in many of the leading industries been finally adjusted to the conditions precipitated by the panic of 1907, creating a general belief that any changes in these industries from now on must be for the better; collections have improved; many of the great railroads have been put in possession of ample funds by successful bond issues; the stocks of merchants generally have apparently been largely reduced, as a consequence of genuine mark-down in prices; though many industries are still running on short time, there has in recent weeks been a strong tendency toward normal working hours; and—of the highest importance—the crop outlook for 1908 is exceptionally flattering. On the other hand, the habits of economy so sharply bred by the crash of last year have still a strong hold on consumers; the possession of large amounts of new money by the steam railroads has not yet had the stimulating effect on the steel and other markets that was looked for; and, according to a widely accepted view, the approach of the presidential election is contributing to the uncertainty. One fact must not be overlooked. The country has not in the last ten years possessed such a large amount of idle money as at present. If stocks of commodities in consumer's hands are today small rather than large, if the crops turn out a few weeks hence as large as they now promise to be, these facts, taken in connection with our extraordinarily large bank reserves, should, on theoretic grounds at least, be conducive to a reawakening of industry in the not remote future.

THE MODERN STRIKE, AS EXEMPLIFIED AT PENSACOLA

Few persons have any real conception of a strike. There is, of course, no mistaking the overt facts by those in the immediate neighborhood; but the meaning of the facts is quite generally overlooked at the time. And when the strike occurs at a distance, the facts themselves, as well as their meaning, are a matter of common ignorance. It is now a truism that "war is hell," but this phrase is really no more applicable to the clash of arms than to the strike, which is the industrial equivalent of physical strife, and which, indeed, frequently resolves itself into physical strife. As the strike lacks the "pomp and circumstance" of war, its impress on the public mind is relatively light, except in the case of the participants and the immediate sufferers. This is unfortunate, for if the public should wake to the fact that the economic loss to the world from strikes—to say nothing of the human suffering entailed—bears no mean comparison to the loss occasioned by the "hell of war," it would unquestionably be quick to express its disapproval of the barbarous methods now pursued. Enlightened minds do not hesitate to speak of war as an anachronism; but, in view of the rising intelligence of mankind, there can be no greater anachronism than the industrial strike. That this is not clearly perceived and made a cardinal maxim of industry, is due to the fact that very few people have any real knowledge of the principles, methods and consequences of the strike.

A concrete case will best illustrate our meaning. Less than three months ago the Pensacola street railway was subjected to a very trying experience by reason of a strike. Only meagre information regarding the cause, the details and the results of the occurrence was printed in the newspapers outside of Pensacola. Hence no adequate knowledge of the situation has been gained by the general public. In point of numbers and capital involved, this strike was a comparatively small affair. It was, however, repre-





Figure 1. A close-up view of the large, dark, textured surface, possibly a wall or ceiling, with numerous horizontal lines or pipes running across it.

sentative in its character, and is consequently as good a study as could be found of the strike principle and methods. And it possesses a peculiar interest for the readers of the Journal, as the Pensacola street railway is one of the properties managed by Stone & Webster.

The principle of the strike is not that workmen have a right to strike, either singly or in a body, when conditions are not to their liking. It is rather that they have the right to dictate who shall and who shall not work for their employers. This was clearly illustrated at Pensacola. The street railway operatives in that city boldly maintained that the company had no right to hire non-union men. That is, they disputed in toto the constitutional right of every man to hire whom he pleases or to work for whom he pleases. This became the point at issue between the Pensacola company and its operatives, after the operatives, by their own conduct, absolved the company from the necessity of living up to its agreement to employ none but union men. Looking backward, it is apparent that the company had the alternative of allowing its employees to dictate its policy in the most essential matter (to the detriment of both its security holders and the general public) or of subjecting itself to a strike, with all its attendant horrors. It would have been neither prudent nor public spirited to select the first course.

The most obvious fact about a strike is that those who instigate it and participate in it are quick to throw moral considerations overboard. Theoretically, there may be such a thing as a high-minded strike, but the Pensacola occurrence did not exemplify this fact. At two points there was a direct violation of contract on the part of operatives. In January the company signed a labor agreement with its men, one of whose terms was that in case of a controversy the matter should be submitted to arbitration. In less than three months this provision was completely ignored by the operatives. Another clause of the January agreement expressly stated that five days' notice should be given the company by the labor association before quitting work for any cause whatever. This clause was also violated by the men.

A feature incidental to many, perhaps most, strikes is a misunderstanding of the situation by the public immediately concerned. This was certainly the case at Pensacola. At the start the bulk of the people were in sympathy with the strikers. The police authorities could not be depended upon for protection, and this was also

true of the county officials. As knowledge of the causes and methods of the strike increased, this attitude changed, eventuating on the one hand in a citizens' alliance to see that justice was done, and on the other in a request from the mayor for state troops to preserve order.

This change of attitude produced a new demonstration of the lawless character of the modern strike. On the night of May 11 dynamite was placed in the heel of a certain switch and was discharged by a passing car. Only a few minutes before the explosion a car heavily loaded with people returning from a citizens' alliance meeting passed over the switch, and it is general belief that the dynamite was used with an intent to blow up this particular car, which happily escaped damage for some unaccountable reason. In short, it looked as if the strikers were as ready to make war on the community as on the company. As a matter of fact a strike, in the very nature of the case, always implies the sacrifice of public interests for private interests.

In almost every instance a strike is apt to partake of the nature of mob rule. Theoretically, perhaps, the strike may have acquired a greater semblance of dignity in recent years, by reason of the fact that it is now ordered and conducted by the national labor organization rather than by the local union. But at Pensacola even this feature was absent. No order came from the central organization; nor was any recognition or aid received from that source. In a word, the local union not only broke faith with the street railway company, but also with federated labor.

In its methods the Pensacola strike was a virulent affair. After flagrantly violating its agreement with the company not to strike without first resorting to arbitration, the local union, once the strike was on, tried repeatedly to get the management to arbitrate the difficulty. That is, the men appeared to regard the agreement of last January as completely binding on the company and as not in the least binding on themselves. Naturally, the company was bound to discard any such notion. In combatting the strikers the company was contending for its legal rights and for the maintenance of its business, but incidentally it was fighting for a great principle—namely, the inviolability of contracts. The only way it could effect its material well-being and preserve the accepted right of contract was to meet the issue squarely, once it was raised.

The effect was instantaneous. None of the cars on the city lines in Pensacola were operated from 7 o'clock on the morning of





April 5 to one o'clock in the afternoon of April 14, when new men from other quarters began to get to work. The first instalment of the new operatives reached the city on April 10, but their arrival was the occasion of a fierce street riot, and it was necessary to guard them at the police station until April 13. When the cars began to run on the following day, the company's city lines were guarded by state troops, and violence and interruption of traffic were prevented. For three or four days no trips were made after 6 o'clock at night, but by the twenty-fifth of the month the regular schedule was in operation once more. One, but only one, interference took place with the cars carrying the United States mail to Fort Barrancas—the authorities promptly and effectively intervened in this case.

All told, it required five or six hundred state troops and an injunction from the United States Court to keep the cars running. One dastardly act of violence occurred on an outlying line, a conductor being shot at and severely wounded.

The strike was officially declared off by the union on May 13, having lasted thirty-eight days. It is important to add, however, that on May 11 the following statement, signed by fifteen of the strikers, appeared in the Pensacola Journal:

We, the undersigned, who have been heretofore employees of the Pensacola Electric Company, and among those who went out on a strike on April 5, 1908, have again accepted employment with that Company, have ceased to belong to Division 234 of the Amalgamated Association of Street and Electric Railway Employees of America, and have signed a contract with the Electric Company, that should we join a union hereafter, our connection as employees with that Company shall cease, and we desire to state to the public, through you, our reason for our action.

We are satisfied that the strike into which we entered was not justified by the circumstances existing at the time, and that it was unauthorized by the constitution of the Association itself. We believe that a further continuance of the strike would not only be a wrong to the public, but would deprive many of us and our families of the means of subsistence, and we cannot think that it is right for us to continue the wrong which we have begun. For these reasons, we have taken the course which we have stated, and believe that the public will appreciate that our position this time is right.

Possibly the philosophy of the Pensacola strike could be no more clearly stated than in these words. It had no justifiable basis; it was a wrong to the public; and it was disastrous to those participating in it. It was a drastic infringement of public and pri-

vate right. In every aspect it was productive of loss. The company not only lost in revenue, but also by reason of the expense to which it was put in getting new operatives from a distance and in housing them and providing a commissariat for them, and by reason of the destruction of property and other circumstances. The men lost their earning power, and their outlook for the future was impaired. And the public lost in more ways than one. It was deprived of transportation facilities, to the detriment of its comfort and its material well-being, and it was subjected to a very considerable expense, incidental to the employment of a large body of militia and to other means necessary to the protection of life and property.

The facts recited above, together with the accompanying illustrations of various aspects of the occurrence at Pensacola, will, it is hoped, contribute to a better understanding of the real nature of the modern strike, particularly as it relates to public service corporations. Corporations of this character are very apt to lack public sympathy in circumstances of this sort. Until the facts of the situation are well understood the average man has a sort of *a priori* conviction that the operatives are the prey of a soulless corporation. The public does not, of course, believe that the man has an inalienable right to the job; but sometimes it acts as if it did. One very noticeable evidence of this is the odium attaching to the term "strike breaker." The strike breaker is commonly supposed to be culled from the refuse heap of labor, and there is a tendency to consider any use of him as censurable. Such notions cannot, however, stand the light of knowledge. A glance at two of the accompanying pictures, showing the strikers and the strike breakers at Pensacola, reveals as high intelligence and self-respect in the one group as in the other—if anything, the balance is in favor of the strike breakers.

A word further should be said with reference to a point already touched upon. We refer to the cost, in effort and money, to a concern engaged in the task of maintaining its constitutional rights, and the results of its industrial enterprise, in the face of a determined strike. The general public, for example, has no idea of the burden imposed on the Pensacola company. The management had no notice of an intention to strike until after the men had actually abandoned the cars. Necessity for action confronted it at a very sharp turn. It met the situation with the greatest promptitude, however, arrangements at once being made in New York for men



to take the place of the strikers. The new operatives were rushed forward from that city, and if the municipal authorities had furnished adequate protection, the car service could have been resumed several days earlier than was actually the case. It was no light task to get together a whole operating equipment at short notice, and to provide them shelter and the facilities for feeding themselves, as was necessary in this instance. When one views the accompanying pictures, showing the armed character of the city, the temporary accommodations of the new men, and the commissary arrangements provided for them, he begins to get some idea of the pecuniary expense and the extraordinary efforts to which the Pensacola company was put.

THE EFFECT OF THE PRESENT BUSINESS DEPRESSION UPON THE EARNINGS OF STREET RAILWAYS

By A. S. MICHENER.*

It is probably evident to most men that a depression in business is reflected to a less extent in the percentage of shrinkage in street railway earnings than in those of the steam railroads. But an examination of statistics published during the past six months discloses the further fact that the street railway business, taken as a whole, has had an exceptionally steady and unique record when compared with the other important industries. Not only has it held its own in the face of one of the most acute depressions experienced in this country, but it has actually shown increases over a very prosperous corresponding period of the previous year.

Up to the time of the October panic, mills, factories and furnaces were pushing their output to the maximum point of production. Beginning, however, almost with the day of the break, practically all mercantile lines felt an immediate contraction in business. Merchants cancelled orders and made frantic efforts for extensions of credit; cash money commanded a premium of 4 to 5 per cent., and even as late as the end of December 1 to 1 1-2 per cent. premium was readily paid for cash; factory doors were closed, or operating time was cut in two; a general embarrassment prevailed in banking circles, with numerous bank suspensions; bank clearings dropped; construction work stopped; freight transportation fell off at an alarming rate. And yet, in spite of all this excitement and the accompanying feeling of despondency in nearly all branches of business, the street railways continued to show increased earnings over the previous year.

From the very instant the public realizes that a period of busi-

*Comptroller Stone & Webster. This article was compiled May 15, 1908, from figures obtainable on that date.

ness contraction has arrived, economy in consumption begins, resulting in a lessened demand for all kinds of goods. The retail merchant naturally feels the first effects of this curtailment in demand, and immediately begins cancelling orders already placed with his jobbing house, or reducing to a minimum the orders which he is compelled to place. The manufacturer is the next to be affected, and, as a curtailment in demand and production is followed by a falling off in the movement of goods, the freight transportation business suffers a serious decline. No more striking illustration is needed than the report of the committee on car efficiency of the American Railway Association, which placed the number of idle cars on April 29, 1908, at 413,338; whereas, on October 30, 1907, there was a shortage of 86,811 cars.

It is well known that the freight business is the meat of the steam railroad industry. On the other hand, with the exception of the interurban lines, the carrying of freight constitutes a very slight, if any, part of the earnings of the street railway companies. Their receipts, under ordinary circumstances, can shrink from no other cause than a reduction in the number of passengers carried, or a reduction in the rates they are allowed to charge.

When it comes to the matter of passenger earnings during a depression, it is natural to expect a less proportionate reduction in street railway traffic than in the passenger traffic of the steam roads, because of the extremely low fares of the former. People will not walk long distances, except when recreation or exercise is the incentive, when a mere five cent piece will save them energy and time; neither can they readily throw off a long acquired habit of short distance riding.

True, factories and mills close down and there is a loss in the riding of wage-earners to and from work, but, aside from this, the street railways do not suffer materially, because the spirit of retrenchment appearing in dull times does not extend with equal force to the cheaper and less inexpensive needs and pleasures of the public—among which is trolley riding. It is perhaps characteristic of the American people that they part freely with their nickels and have an almost universal contempt for an economy that begins with the small coin. In proof of this is the successful season of the cheaper places of entertainment. Thousands have been unemployed, yet these low priced places of amusement have been packed nightly to the walls.

The effect of the depression following the October panic, upon

the banking, mercantile, industrial, steam railroad and street railway industries, is graphically shown by the figures compiled below.

BANK CLEARINGS

Following is a statement of the bank clearings of the United States for six months ending April 30, 1908, as compared with the corresponding period ending April 30, 1907. Between November 1, 1907, and May 1, 1908, the clearings fell off \$23,414,749,028, or 28.5 per cent.:

	1907-1908.	1906-1907.	Decrease.
October	\$13,779,790,076	\$14,550,027,603	5.3%
November	9,659,316,632	13,656,039,900	29.3%
December	9,407,038,651	14,285,466,619	34.1%
January	11,359,308,232	15,054,655,406	24.5%
February	8,756,701,857	11,823,958,740	25.9%
March	9,777,937,943	14,657,900,282	33.3%
April	9,764,600,519	12,661,631,615	22.8%

BANK FAILURES

	1907.	1906.	Per cent. Increase.
Liabilities of Failing Banks	\$233,325,972	\$18,805,380	1140.7

COMMERCIAL FAILURES

	1907.	1906.	Per cent. Increase.
Liabilities of Failing Cos..	\$197,385,225	\$119,201,515	65.6
	4 Mos. Ending Apr. 30, 1908.	4 Mos. Ending Apr. 30, 1907.	Per cent. Increase.
Liabilities of Failing Cos..	\$98,091,956	\$49,009,557	100.2

NET EARNINGS U. S. STEEL CORPORATION

	1908.	1907.	Per cent. Decrease.
January	\$5,052,743	\$12,838,703	60.6
February	5,709,428	12,145,815	52.9
March	7,466,834	14,137,974	47.2
Total for Quarter...	\$18,229,005	\$39,122,492	53.4

STEERAGE ARRIVALS AND DEPARTURES

	1st 4 Mos. 1908.	1st 4 Mos. 1907.
Arrivals	124,392	404,332
Departures	243,023	80,427

GRAIN CROPS

	1907. Bushels.	1908. Bushels.	Per cent. Decrease.
Wheat	634,087,000	735,260,970	13.7
Corn	2,592,320,000	2,927,416,091	11.5
Oats	754,443,000	964,904,522	21.7
Barley	153,597,000	178,916,484	14.2
Rye	31,566,000	33,374,833	5.4
	Bales.	Bales.	
Cotton	11,973,000*	13,550,760	11.6

STEAM RAILROADS

Car Surplusage

October 30, 1907.....	86,811**
February 5, 1908.....	342,828
March 18, 1908.....	296,035
April 1, 1908.....	307,979
April 15, 1908.....	375,624
April 29, 1908.....	413,338

STEAM RAILROADS

Gross Earnings

	No. of Roads.	Current Year.	Previous Year.	Increase.	Increase.
May 1907	121	\$195,943,305	\$165,890,345	\$30,052,960	18.12
June "	121	183,125,657	161,235,109	21,890,548	13.59
July "	116	187,069,790	163,685,258	23,384,532	14.28
Aug. "	121	197,288,033	175,726,323	21,561,710	12.27
Sept. "	118	192,548,022	175,505,039	17,042,983	9.71
Oct. "	120	213,697,727	196,843,678	16,854,049	8.56
Nov. "	120	189,988,564	184,197,391	5,791,173	3.14
Dec. "	123	174,422,451	184,893,810	—11,471,359	—6.20
Jan. 1908	122	151,758,406	172,283,006	—21,524,600	—12.49
Feb. "	123	141,256,206	160,150,610	—18,894,404	—11.79

(Covers 55 roads only)

Mar. "	55	54,549,532	63,700,200	—9,150,668	—14.36
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(Covers 53 roads only)

Apr. "	53	46,398,330	57,884,380	—11,486,050	—19.85
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The gross and net earnings of all the steam railroads for the

*Estimate N. Y. Cotton Exchange December, 1907.

**Net shortage.

first four months of the present year could not be found from data at hand, so the following roads were taken to illustrate the trend during this period:

Baltimore & Ohio,
Erie,
Illinois Central,
Louisville & Nashville,
Pennsylvania (East of Pittsburg & Erie),
Reading (Railway & Coal),
Southern Pacific,
Union Pacific.

The total gross and net earnings of these companies for the first four months of 1908, as compared with the first four months of 1907, were as follows:

Gross Earnings			
	1908.	1907.	Per cent. Decrease.
January	\$50,440,632	\$53,855,082	6.3
February	44,380,426	52,238,867	15.4
March	40,811,925	47,568,031	14.2
April	45,935,071	53,796,024	14.6
Total	\$181,568,054	\$207,458,004	12.4
Net Earnings.			
	1908.	1907.	Per cent. Decrease.
January	\$13,086,814	\$17,632,732	25.7
February	9,647,218	15,766,770	38.8
March	8,363,740	12,546,204	33.3
April	12,584,725	15,404,317	18.3
Total	\$43,682,497	\$61,350,023	28.7

STREET RAILWAYS

In sharp contrast to the above is the record of the street railway industry. Many of the street railway companies do not publish monthly reports of earnings, and from the data at hand it was possible to get the figures for only 45 companies; but, while a number of the largest city systems could not be included, those making up the number shown are scattered all over the United States, and as practically every one shows an increase over 1907,

the result can be taken as representative of the street railway companies of the country as a whole.

GROSS EARNINGS OF 45 AMERICAN STREET RAILWAY COMPANIES.

	1st 3 Mos. 1908.	1st 3 Mos. 1907.	Per cent. Increase
Stone & Webster Cos....	\$3,063,619	\$2,801,033	9.3
Other Companies.....	14,956,710	14,355,705	4.3
Total	\$18,020,329	\$17,156,738	5.0

The steam roads showed an increase in gross earnings for 1907 over 1906, as the effect of the depression was not felt until during the months of November and December, but in the case of net earnings there was a decrease of 9.4 per cent., and in that particular the street railway business again shows to advantage with an increase in net of 6.06 per cent.

The following table shows the gross earnings and net earnings for steam roads and street railways for the years 1906 and 1907:

Gross Earnings			
	1907.	1906.	Per cent. Inc.
Steam Roads.....	\$2,287,501,605	\$2,090,595,451	9.4
Street Railways.....	235,718,432	212,442,906	10.9
Net Earnings			
	1907.	1906.	Per cent. Inc.
Steam Roads.....	\$660,753,545	\$665,280,191	-.7
Street Railways.....	100,526,762	94,778,321	+6.0

While the street railways feel a business depression less than the steam roads, they will also, to the extent that they have been affected, show a quicker recovery, for the increased riding by wage-earners is simultaneous with the resumption of operation by the mills and factories.

HIGH TENSION SWITCHING

By R. A. PHILIP.*

In the present state of the art in this country, constant potential alternating current systems are the only ones requiring high tension switches for their control so all direct current systems and all series systems may be neglected.

Considering now only the constant potential alternating current systems, it is difficult to further limit the subject by drawing a line to set off high tension switching from moderate or low tension switching.

Fifteen years ago 1,000 and 2,000 volts was regarded as high potential, ten years ago 10,000 volts was very high potential, today it is a question whether 10,000 volts is not too low to be considered high potential, which term would then be limited to potentials of from 20,000 to 60,000 volts; anything above the latter figure may be considered as very high potential at the present time. There is no reason to doubt continued progress along the same line, so that it will probably not be long before 100,000 volts is regarded as a commercially usable high potential, and after that still higher potentials may be expected.

To trace the influence of increase of potential and power on switching problems, the function of a switch may first be noted.

First—a switch when closed connects two conductors and permits the flow of electric current. These currents flow through the blade and contacts of the switch and produce heat. The maximum capacity of the switch in amperes is limited by the highest temperature at which it is safe to run it. In general the larger the current the larger the switch. A switch to carry one ampere can be made from an ounce of copper and can be opened and closed with one finger. To carry ten thousand amperes the blade of the switch must be very massive, say with a cross section of ten square inches, and requiring the full strength of the arm to open and close.

*Of the Stone & Webster Engineering Corporation. This article embodies a talk by Mr. Philip at the Massachusetts Institute of Technology March 17, 1908.

Second—when open, a switch separates two conductors by interposing a resistance which prevents the flow of electric current. The electro-motive forces tending to produce flow of current create a stress across the opening in the switch. This stress may break down the switch's resistance, either by a spark jumping directly across the air gap in the switch or by current leaking around the gap along the surface of the insulating materials. In any case the maximum capacity of a switch in volts depends on the highest stress which it is safe to permit across the break. As before, we may say, the higher the potential the larger the switch. A switch for one volt can be made with a gap as short as desired, any convenient fraction of an inch would do very well, while for 50,000 volts it is customary to have a gap of about two feet. Similarly for a one-volt switch a block of wood can be used for the insulating frame, while a 50,000 volt switch requires large special porcelain insulators.

We have considered separately the effect on switch design of the two simplest functions of a switch, we may now consider the joint effect as illustrated in commercial switches. That species of switch known as disconnecting switches illustrates the point perfectly. Compare the three following switches:—

Rating.		Blades.		Break	Insulation	
Amp.	Volts.	No.	Size.		Base.	Additional.
300	2500	1	1½ in. x ¼ in.	6½ in.	Marble	none
3000	2500	3	3¼ in. x ¼ in.	8 in.	Marble	none
500	66000	1	2 in. x ¼ in.	24 in.	Marble	Porcelain
					2-14 in. d. x 15½ in. h.	

Since the size of a switch increases both as the amperes and the volts, it will evidently also increase as the product of the volts and amperes. We, therefore, see immediately that the size and consequently the cost of a switch depends on the amount of power to be transmitted through it. In the case of disconnecting switches the rate of increase is slow.

Two more functions of the switch may be considered. Third—at the instant of closing the switch equalizes the potential on the two sides of the break, producing a momentary disturbance in the currents and potentials of the system accompanying the transition from one state of steady flow to another. If we consider any symmetrical system, say a three-phase system, we see that if we have a switch in each phase and close them one at a time three separate disturbances are produced, also that there are two unnec-

essary intermediate states of steady flow between the initial and final conditions. Moreover, the condition being unsymmetrical, except when all switches are in or all are out, there is a chance for unforeseen disturbances. For this reason the switches on the different polarities are coupled together to act as a unit, such a unit being called a two, three or four pole switch as the case may be. The simultaneous action of such a switch greatly simplifies switching problems and admits of the disturbances on the different polarities at moment of switching neutralizing each other as far as possible.

The fourth function occurs at the time of opening a switch. At this instant the switch separates a system of conductors into two parts. To do so it must forcibly divide the currents and potentials, so that instead of flowing as a single system they flow as two separate systems. The phenomena at the instant of opening are very numerous and complex. They are, however, of the greatest practical importance, because it is on account of them that the most important peculiarities of high tension switching practice exist.

Summarizing briefly, we may note that in addition to resistance, all electric conductors have self induction and capacity, also that self induction and capacity have complementary characteristics; that is, the first produces a voltage proportional to rate of change of current, while the latter produces a current proportional to rate of change of voltage. Consequently, the action of a switch in changing the currents and voltages of the system, causes the inductances and capacities of the system to bring into existence new currents and voltages which are superimposed on the original ones. Since if a switch is opened in a given time the average rate of change of current would be proportional to the current, and the average rate of change of potential would be proportional to the potential, it follows, that some phenomena will be proportional to the current and others to the potential.

Again, we see that if these strains increase, both with current and with potential, they must increase with the product, so that the greater the amount of power switched, the greater the disturbance.

In general, increase of voltage has been coincident with increase in power, so that the problem of high voltage switching has become indistinguishably merged with that of high power switching.

With increase in currents and voltages, it was found that ordinary type switches, even if properly designed for amperes and volts as before described, could not be used to switch large amounts of power. If the voltage was not very high, say 2200 volts, but the current was large, an arc of such volume would be formed that it would spread all over a switchboard, melting switches and bus bars. If the voltage was high, but the current small, the arc would stretch out for many feet, and before breaking would be liable to attach itself to metal work of the roof, etc. I have never heard of an attempt to open a circuit in which both the current and voltage were large, with this type of switch.

To circumvent the difficulty, various ingenious make-shifts have been devised. A single example will illustrate the underlying principle of many. For instance, consider two transformers in multiple each with switches on both high and low tension side. Either transformer can be switched in or out with a disconnecting switch provided the other remains in circuit, because as the current in it diminishes the current in the other increases proportionately so that the net disturbance in the system as a whole is very small. Again, it is found that for moderate amounts of power the disconnecting switch is more effective at low than high voltages; therefore, in switching out such a transformer from a bank it is easier to open the switch on the high tension side first; and in switching it in, to close it last. It is of course, to be remembered that to switch a transformer in or out of multiple with another both high and low tension sides must be switched.

It soon came to be seen that the ordinary switch was unsuitable for high power switching and that a new type was required. This was found in the oil switch, in which the break occurred in oil instead of air. To contain the oil a metal case or oil pot was necessary, which, however, gave the important advantage that the arc was thereby confined to a definite place. The case could be grounded so that oil switches could be safely placed in much greater proximity to each other than air break switches and the danger to attendants reduced. With oil switches the breaking of the circuit was found to be accompanied by less disturbance than with air switches, and the switch was found to be very effective in rupturing the circuit in spite of disturbances. However, it was found that in very high power circuits, the rupturing of the circuit under extreme conditions would produce a small explosion in the switch, driving the oil out of the pot.

As additional safeguards, separate oil vessels were provided for each pole of a multiple pole switch; then two breaks were used on series of each pole, each break being in a separate oil vessel, and the oil pots on each pole were enclosed in a small masonry cell.

The size of oil switches also increases with increased power to be switched.

First, the contacts must be increased for increased current; second, the break increased for increased voltage; third, the poles must be separated and enclosing cells must be added for increased power.

To illustrate what this means, we may compare a switch for 200 A., 750 Kw., at 2200 volts with one for 100 A., 10,000 Kw., at 60,000 volts. The first requires a space 15 in. deep, 8 in. wide, 34 in. high; the latter a space 12 ft. long, 5 1-2 ft. wide, 12 ft. high.

One point to be noted is that there is a mechanical difficulty in constructing oil switches for very large currents, so that for very large amounts of power, say 10,000 Kw., it is easier and cheaper to control them at 10,000 volts than at 2000.

The increase in the size of the switches necessitated corresponding change in methods of operating them.

The small oil switches, like the air switches, were operated by hand as directly as practicable. The use of enclosing cells necessitated the switch being at a distance from the operating handle with lever and rods between. With increased size of switches the moving mechanism became too heavy to operate by hand, so auxiliary power was necessary. Electric power was found most suitable for this purpose. It enabled an oil switch, no matter how large, to be operated by a very small control switch, which could be located at any convenient distance. Two distinct types of operating mechanism have been devised: first, where the switch is moved directly by the action of a solenoid; second, where the switch is moved by a spring, which is wound up by an electric motor. A peculiar feature is, that while these large oil switches are used for alternating current only, the operating mechanisms have not been developed for anything but direct current, making it necessary to introduce various complications to get the direct current.

Here it may be mentioned that the separation of the main and auxiliary switch makes it impossible for the operator to see whether the main switch is open or closed. To remedy this, aux-

iliary indicating circuits are run causing the lighting of a red indicating lamp when the main switch is closed and a green lamp when open.

The use of the auxiliary current for operating the switch also requires auxiliary wires between the control switch and the main switch. The multiplication of auxiliary circuits has been one of the complications which seem characteristic in the development of high power switching.

While oil switches are necessary for switching large amounts of power, disconnecting switches are usually connected in series with them on each side. These switches are intended to be used only when the circuit has already been broken by the oil switch, and are for the purpose of permitting the oil switch being examined or repaired with safety.

A comparison of a disconnecting switch and an oil switch, each for say 100 amperes and 50,000 volts, gives a good idea of the influence on switch design from the momentary disturbance due to opening and closing high power circuits.

In addition to being able to disconnect circuits at will, it was early in the art seen to be necessary to provide automatic means for disconnecting them whenever the current in them exceeded the normal value.

The simplest devices for this purpose are called fuses and consist simply of an easily fusible metal strip inserted in the circuit. These were found to have much the same limitation as air break switches, being good for small amounts of power and failing on large amounts. By enclosing the fuse in various ways, improvements have been made, giving the fuse a much greater range of usefulness than a simple fuse could have. It has been supposed that since a switch breaking in oil is vastly superior to one breaking in air, a similar advantage would hold in case of a fuse; but experiment seems to demonstrate that this is not correct.

The real solution of the problem has appeared to lie in a different line. By inserting a solenoid in the circuit to be protected, it is possible to cause it to automatically trip an oil switch which will disconnect the circuit. Such an automatically tripped oil switch is often called a circuit breaker. While a fuse responds to increase in amperes only, a circuit breaker can be equally well actuated by change of voltage or frequency. Perhaps the prime advantage of the circuit breaker over the fuse is that if it opens it can be closed again instantly if desired. Another important advan-

tage is that the circuit breaker can be made to open all poles of a circuit simultaneously, while fuses may not all blow, thus leaving the circuit only partially disconnected. The advantages of the circuit breaker are so numerous that they have largely displaced fuses for first-class work for 2200 volts and above. The result has also been that so many oil switches are now equipped as circuit breakers that the terms are sometimes used interchangeably.

The increase in voltage of circuits and size of oil switches has complicated the application of automatic trips to oil switches. With increase of voltage, it was found dangerous to lead the main line current through the tripping solenoid, so that a transformer was inserted and the secondary current from it used in the trip coil. This transformer is inserted in the circuit so as to be in series with the load, for which reason it is sometimes called a series transformer; it gives a secondary current directly proportional to the main current and is, therefore, also called a current transformer. This was found to be such a great improvement from the standpoint of safety to the operator that it is used for almost all oil circuit breakers of 2200 volts and above.

With use of electrically operated switches another difficulty arose; namely, the current from either the main circuit or current transformer was alternating current, while that required for the operating mechanism was direct. To overcome this, a device called a relay was inserted. This consists merely of alternating current solenoids arranged to close contacts in a direct current circuit through the trip coils of the switch.

For other purposes numerous other kinds of relays have been devised. Of these, the time limit relay is the most important. An ordinary overload circuit breaker will trip the circuit immediately after the current exceeds a certain value. When equipped with a time limit relay, it will not open it unless the excess is of some appreciable predetermined duration. In other words, the circuit breaker ignores momentary fluctuations. There are several varieties of time limit relays, definite time and inverse time being the principal. Of the other relays, differential and reverse current are perhaps the most common.

Without going further into the question of relays, it may be pointed out that with increase in size of the switches numerous other refinements in automatic devices have been required, resulting in an ever-increasing complication.

In power houses and sub-station the various oil switches are

usually grouped together in a building or part of a building called a switch house. Some idea of the change in power house design which has been forced by use of high power may be gathered from the fact, that while in old power house all the switching apparatus was sometimes in a space only three feet wide along one wall, in a modern power house the switch house may amount to almost one-half of the whole.

In a modern high tension switch house certain principles are usually followed. First, it must be possible to repair any part of the equipment without interrupting the service furnished; second, all parts of the high tension wiring should be enclosed in masonry cells so far as financial considerations permit; third, all parts of the switch house should be strictly fire-proof.

Switch houses constructed according to these principles show a combination of solidity and complexity, which seems to characterize the tendency of high power switch development. The cost of such construction is enormous and is only justified by the great amount of power controlled. An important deduction from this fact that the cost of switching is a very important matter at high voltages is that it is uneconomical to use an unnecessarily high voltage.

FALL RIVER'S GREATNESS AND THE EFFECT ON THE GAS INDUSTRY

In many ways Fall River is one of the most interesting cities in the United States. It practically owes its all to cotton manufacturers, ranking today as the first cotton textile centre in the country. It is chiefly a city of big mills and small homes. With a present population of upwards of 112,000, it has a mill force of about 33,000. That is, about one person in every three in Fall River is employed in the mills. In many families every member is so engaged. It frequently happens that persons having business at the tenements of the operatives have to pursue it out of mill hours, no one being on the premises to attend to them. This is notably the case with the men who read the meters for the gas company.

In one aspect, therefore, Fall River may be described as one of the most pronouncedly retail communities in America. The great bulk of its people are of small, or at best of only moderate, means—persons from whom the necessity of economizing is never absent. As regards the effect on certain of the local industries, this is an element of strength. Here again the gas company may be cited. The character of the population has imposed on the company the necessity of getting the cost of production and the price to the consumer down to the lowest attainable figures; but this very fact has had a strong tendency to increase the volume of its business to maximum limits. The result is seen in a highly prosperous and effective gas industry.

Four years ago was an interesting period for Fall River. In 1904 occurred the semi-centennial of the municipal government. The previous year, it may be added, rounded out the first hundred years of the life of the township of Fall River. The present bustling industrial centre was originally part of Freetown, from which it was separated in 1803. The growth was nothing extraordinary during the first fifty years, though the town gained some importance in cotton manufacturing during the second war



with England, and made appreciable headway between 1820 and 1830. Still, it had a population of less than 13,000 when it obtained its city charter in 1854. At that time it possessed nine mills, containing 117,636 spindles, 2,858 looms, the annual production amounting to 21,882,341 yards of cloth, and the number of operatives to 2,200. The place then ranked thirteenth among the cities of Massachusetts. The Civil War brought with it a vitalizing influence. By 1872 Fall River had mounted to the third position in the Commonwealth, which it occupies today, being exceeded only by Boston and Worcester. In 1871-72 fifteen new mill corporations were formed, and activity in the way of new construction was witnessed on every side. In the year 1872 alone, eleven mills of from 30,000 to 40,000 spindles each were erected, the capital outlay being \$10,000,000; as a result 5,000 new operatives were added to the labor force of the city, and the total population was swelled to the extent of 15,000.

Since then the growth has been very striking. At the time of the semi-centennial in 1904, figures were compiled that showed that in the past twenty years the population had nearly doubled; in thirty years it had nearly tripled, and in thirty-three years it had quadrupled. The city had also, declares one authority, doubled and tripled in valuation, "notwithstanding a very material reduction in scaling down inflated war values to a gold basis."

Fall River is what she is today by virtue of natural conditions. The city is located on Mount Hope Bay, at the mouth of the Taunton River, which has given her exceptional transportation facilities, and enabled her to take sixth rank among the Atlantic seaboard cities. She is also located on the Fall River, a small stream having its source in a chain of ponds two miles to the east of the city. The river has a fall of some 129 feet in less than a half a mile, and runs for almost its entire length on a granite bed, and for a large part of the way is confined between high granite banks. Its facilities for power purposes are exceptional, and along the river is naturally where we look for the oldest mills. It may be stated that the Fall River Gas Works Company owns rights to 5 per cent. of the stream, a valuable asset. The city, however, long since outgrew the use of water as a motive power. Its location on the bay affords its great advantages in the matter of its coal and other supplies. The harbor is commodious and deep enough for vessels of the largest class, and there are daily lines of steamers to Providence, Newport, and New York. Fall River also possesses a freight

line to Philadelphia. In short, it has all the facilities for manufacturing on a large scale at low cost.

Fall River as we find it today (or in 1906, when the latest figures at hand were compiled) is something like this. The population is about 113,000, as compared with 11,170 in 1850. Since 1854 the valuation has increased from \$8,939,215 to \$83,465,821. The number of incorporated cotton mill companies is forty-four, owning 102 mills, with an incorporated capital of \$26,525,000, but a probable investment of upwards of \$50,000,000, containing 3,390,703 spindles and 82,658 looms. Briefly, Fall River has more than one-seventh of all the spindles in the country, nearly one-quarter of those in New England, and manufactures over three-quarters of all the print cloths. It has more spindles than any state in the Union except Massachusetts and more than twice as many as any other city in the United States. Its banking facilities are ample, its four savings banks having nearly 50,000 depositors, with about \$20,000,000 of deposits. The city is 49 miles south of Boston, and 183 miles northeast of New York, and is abundantly supplied with railroad facilities.

Its population, like that of most of our northern mill towns, covers many nationalities. Roughly, there are about 15,000 of American parentage, 15,000 English, 25,000 Irish, 30,000 French, 5,000 Portuguese, 6,000 Hebrews, and about 10,000 Armenians, Russians and Italians. Practically all of these are dependent on the mills for their well-being. That is, it is the mills that furnish the prosperity, directly or indirectly, for the whole population. Fall River, therefore, waxes and wanes as the cotton manufacturing industry is flourishing or depressed. Until very recently this industry has enjoyed a decade of extraordinary prosperity, with only occasional set-backs. Fall River, for example, passed through one of the most eventful strikes in our history in 1904, which lasted for six months. And, of course, the city, like other textile centres, was adversely affected by the financial panic of October, 1907. Conditions, however, have improved of late: the recent wage reduction has been followed by increased running time, and the situation at the mills is for the time being practically normal.

Nothing, perhaps, reflects so accurately the peculiar character of the population of Fall River as the business done by the Fall River Gas Works Company. The company has taken advantage of the fact of the ever present need of economy in the great bulk of the homes of the city. This need is a very real need, indeed. The

FIGURE 10.10. Aerial view of the Washington Monument in Washington, D.C.



average wages paid in the mills are not large, and every dollar has to be made to go the longest way possible. This fact has brought to light the economy of gas for fuel purposes. Gas, furthermore, conduces to economy in time and effort, as well as in money, and this means not a little to the operatives in the mills. The operatives get to their work at half past six in the morning, and they are very greatly facilitated in so doing by being freed from the necessity of starting and looking after coal fires. Today the Fall River Gas Works Company has outstanding nearly 19,000 meters, this large total being in very considerable measure indeed traceable to the use of gas for fuel in the tenements of the operatives. An idea of the external appearance of the homes of the mill hands may be gained from the accompanying illustration. The city is filled with the operatives houses, most of them containing three tenements.

A clearer idea will perhaps be obtained of the amount of business done among the mill operatives, if we state that the books of the gas company show about 1,000 sets and removes of gas meters a month. The total for last year, in fact, amounted to around 15,000. In getting this class of business, the company stands the expense of connecting the main with the stove.

The Fall River Gas Works Company has been bound up with the material interests of the city in a peculiar and interesting way. It is, in fact, an outgrowth from the "Fall River Iron Works," a term whose meaning will not be readily understood outside of Fall River. The Fall River Iron Works is today a great cotton manufacturing plant, not even remotely identified with the iron industry. The case was, however, quite otherwise in 1845, when the company was organized. It began as an iron industry. Gradually, however, it took on other functions. Among these was the manufacture of gas. By and by there was consolidated with this gas business that of the Manufacturers' Gas Company of Fall River, which was organized in 1867, for the purpose, primarily, of supplying a few mills in the southeastern section of the city, and which went into insolvency in 1878. In 1880 the Fall River Iron Works was divided into five corporations, as follows: the Fall River Machine Company, the Fall River Steamboat Company, the Metacomet Mills, the Fall River Gas Works Company, and the Fall River Iron Works, whose plant is now operated for cotton manufacturing purposes. The original capital stock of the Gas Works Company was \$288,000.

In 1902 the management of the Fall River Gas Works Company was lodged with Stone & Webster. With the extension of the industry the capital stock has risen to \$690,000, there being no bonded indebtedness. The great success of the business is clearly shown by the fact that last year, on a total capitalization of \$690,000, there were gross earnings of \$396,634, or over 57 per cent. For many years the company has paid 10 per cent. on its stock. In the last five years it has reduced the price of gas 10 per cent., and has increased its gross earnings \$100,000. The report of the Massachusetts Gas and Electric Light Commission shows that the Fall River Gas Works Company's price for gas in the holder is the cheapest in the state. The whole price history of the company is interesting. In 1885 the cost to the consumer was \$2 per thousand, which by 1901 was reduced to \$1.15. The next year (when Stone & Webster assumed the management) a cut was made to one dollar, and in 1906 the present rate of 90 cents was established.

The Fall River Gas Works Company operates a water gas plant exclusively. It occupies an area of two acres, and has a capacity of 4,000,000 cubic feet per twenty-four hours, its present annual output being 500,000,000 feet. The summer load is 80 per cent. of the winter load. The plant was originally constructed for coal gas, and consisted of meter, purifier, retort house and coal storage buildings of stone. The oldest of them were probably constructed more than 50 years ago. In 1902 a large addition was made to the plant, new purifier, power, meter and condenser houses being added, as well as an oil tank of 150,000 gallons capacity. With the 90,000 gallon tank previously installed, and another 150,000 gallon tank added in 1907, there is now a storage of 390,000 gallons. Seventeen years ago water gas was substituted for coal, the coal gas benches being replaced by water gas generators.

The water gas generators are United Gas Improvement Company 8 ft. 6 in. double superheater improved Lowe sets—four in number—each capable of producing a million cubic feet in twenty-four hours. Coal storage is 2,000 tons of anthracite broken coal. In the power house are the boilers of 500 H. P. capacity and most of the moving machinery, consisting of engines, blowers, gas exhausters and pusher, water and oil pumps. Adjoining the condenser house is a building containing a dining room, shower baths, toilet arrangements, etc., finished in oak and marble; commonly known as "The Club." Most of the buildings are of fireproof con-

struction. There are two relief holders, each of 60,000 feet capacity, and one commercial holder of 750,000 cubic feet capacity.

Gas is distributed from the manufacturing plant through a governor under low pressure directly to a large section of the city. There are also four outlying holders, supplying different districts some distance away, which are fed by high pressure trunk lines. One of these holders, of two million cubic feet capacity, is located on the eleven acres of ground belonging to the company two miles and a half away to the south on the shore, where there is also a wharf having 18 feet of water.

SOME GENERAL NOTES ON THE OPERATION OF CURTIS TURBINES

By FRANK H. TAYLOR*

In order that any prime mover may prove efficient it is necessary that it receive intelligent care. For this reason it is necessary that an operating engineer should make himself thoroughly familiar with the underlying principles governing the various parts of the machines of which he has charge. He can then readily understand the instructions contained in such instruction books, etc., as are issued by the manufacturers, also make such changes and repairs as emergencies or normal operation may require.

Unless such intelligent interest is displayed, no amount of printed instructions will insure the desired success. In the following, therefore, I shall confine myself more to fundamental principles than to specific instructions.

The Curtis turbine of the vertical type, necessitates the use of a step bearing, the function of this bearing being to carry the weight of the rotating element. The step bearing consists of an upper plate attached to shaft, and a lower fixed plate. The plates are recessed and the lubricating fluid is introduced into this chamber at sufficient pressure to separate the plates, floating the rotating element, the distance the plates are forced apart being dependent on quantity of fluid forced between them per minute. Even with maximum quantities called for this separation is quite small. A baffle is provided in the line between pumps and step, the object of this baffle being to provide means for steadying and regulating flow and varying pressure, also to equalize the pressure in those cases where several machines are operated in parallel from the same header. Between baffle and step a pressure gauge is provided for showing step pressure. The pressure as indicated on this gauge is one of the best indicators of condition of step bearing plates.

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A badly fluctuating pressure always means trouble. The plates may not be properly installed thus causing them to touch slightly or pumps are not acting properly, due probably to poor valve action. As load increases on turbine, pressure slightly increases. A loss of step pressure will cause cutting of plates and is due either to a failure of pumps or obstruction of supply to step.

It should be borne in mind that as the rotating element floats and size of upper step block remains fixed the pressure for any given size of unit remains a constant, and therefore any altering of baffle can only vary the amount of flow with a given header pressure.

Immediately above the step bearing plates, a guide bearing for shaft is provided. The lubricant after passing between step plates finds its exit through this bearing; this thoroughly provides for its lubrication.

The lubrication of upper bearings is provided from step bearing pumps, suitable valves being provided in line for regulating supply.

The upper bearings act merely as guides and their proper operation depends upon a free oil supply. A good film of oil in bearing has a cushion effect. If such film of oil does not exist a chattering of shaft is set up which tends to make the whole machine vibrate. This would be so, even though sufficient oil may be provided to keep bearings from heating.

The lubrication of bearings leads to subject of oil throwing, which should not be allowed to continue under any condition. While oil itself is not injurious, its presence on windings collects dust and dirt, stopping up air ducts and seriously interfering with ventilation, thus causing generator to heat. The bearings are carefully designed and great care is exercised to obviate any throwing of oil, nevertheless cases arise where after machine has been in service some time such a condition is noticed to exist. Careful and intelligent study will always suggest a remedy. In the bearing chambers at end of bearings there is usually more or less oil in form of spray and vapor. Where oil throwing is in evidence it is almost invariably due to this spray and vapor being drawn from bearing by windage of machine, either by drawing air directly through bearing passages or else creating a vacuum around bearing.

The drawing of air through bearing would naturally be stopped by closing such opening to the passage of air. If air comes through oil drain, the drain should be trapped in some sim-

ple manner, sufficient head being provided above trap to keep oil from backing up in bearing.

If vacuum is the cause, properly designed pans, piped to atmosphere outside of machine, with felt washers bearing against shaft may be placed at top and bottom of bearings; air will thus be drawn from point remote from bearing, none coming from bearing itself.

The diaphragms separate the stages of the turbines. The diaphragms bear a heavy pressure from steam on their upper surfaces. This pressure holds them down and makes steam-tight joints on the ledges where they rest.

Where the shafts or hubs pass through diaphragms, rings are provided for the purpose of diminishing leakage between stages to a minimum. There are several different designs of these diaphragm rings, but the object of each is the same, and that is, to provide a simple device which is not sufficiently rigid to injure the shaft or hubs, and which can yield or move sufficiently to allow the shaft to revolve without touching. Bad vibration or chattering of the shaft, which may arise from neglected bearings or other causes, may do injury to these rings which will necessitate their renewal. In some designs, the rings are free to move, in others they are free to move outward, but cannot get against the shaft. In every type the rings are prevented from turning.

Where shaft passes through turbine casing carbon packings are provided, the function of this packing being to prevent steam blowing past shaft from casing when pressure in casing exceeds atmosphere, and to prevent air being drawn in when pressure in casing is less than atmosphere.

On the high pressure end of turbine, the carbon packing consists of several sets of carbon rings placed in chambers in a retaining casing.

The carbon rings are made up of segments held together by springs, sufficient clearance being provided between shaft and rings so that they will not grip shaft.

In order to remove what steam forces its way from turbine into this casing a drain is attached, which is connected to the lower stages of turbine; a three way cock is provided in this drain for proper regulation of suction, in order that vacuum may not be impaired.

A live steam connection is also provided to carbon casing, for use in case a vacuum exists in first stage.

The principle of seal on low pressure end of turbine is practically the same. A steam connection is provided to carbon casing, thus enabling a pressure greater than atmosphere to be maintained in casing. A drain is provided for carrying off condensation of this steam. A vent pipe to atmosphere is also provided to chamber between oil and packing casing in those machines that have bearing within exhaust base.

This seal should be made before starting vacuum pumps, otherwise air may leak in; or in those cases where guide bearing is within turbine casing oil may be drawn over.

The regulation of the turbine is of course dependent upon good action of the governor. The action of governors is dependent upon a balance between forces exerted by springs and centrifugal effort of weights. The springs of our governors are adjustable by a thread at the top, and the weights are adjustable by the insertion of screw plugs. To get good results, these adjustments must be so made that the degree of movement throughout the whole range will be nearly proportional to the speed variations. A perfect conformity is not possible, since the effort of springs if plotted would be represented by a straight line, while that of the weights would be represented by a curve.

A conformity close enough for all practical purposes is, however, easily obtainable, and is provided for when governor is adjusted. Governors are provided with auxiliary springs for varying speed in synchronizing. If, for any reason, it is desired to permanently change the speed at which the governor operates, this should be done by nut at the top of governor. These changes can only be made through a comparatively small range either side of the speed at which governor is designed to operate without affecting the regulation.

The action of the governor is necessarily dependent upon the absence of friction from its moving parts. All knife edges and joints should be renewed if wear causes any appreciable deterioration of regulation. The transmission bearing at top of governor should be kept in good condition, sufficient oil being provided to keep it lubricated.

Since any steam turbine can accelerate at a very rapid rate, and as increase of speed may not be easily perceptible, all turbines are provided with speed limiting devices. These devices are dependent upon centrifugal action of weights balanced against springs. As soon as the centrifugal effort of masses overcomes the

spring tension, a light tripping device is brought into play which closes throttle. It is very important that these devices be tested frequently, about once a week, to see that they are in perfect operating condition.

Three different types of valve movement have been used with Curtis turbines—the electrical, mechanical and hydraulic.

The electrical types are controlled by a small controller which is regulated by the governor. The valves consist of a number of separate units, a small finger of control making or breaking contact on a cylinder causing valve unit by means of a solenoid, either to open or close, no intermediate position being allowed for. With this type of valve it is essential to see that wiring from controller to valve solenoids is kept free of short circuits, and that the various contacts of the circuits are kept in good shape. The valves themselves should be kept in good repair, no binding or undue wear being allowed.

The mechanical type consists of a number of separate valve units which are actuated by a worm gear on shaft; the opening and closing of the valve units being controlled by tripping devices regulated by governor. The valves are either open or closed, no intermediate position being allowed for. Care must be exercised in seeing that various parts are kept in repair.

The hydraulic type consists of a number of separate valve units, the opening and closing of these units being controlled by a cam shaft. This shaft is actuated by a hydraulic cylinder, the admission of liquid to this cylinder being regulated by a small pilot valve which is controlled by the governor. The cams on cam shaft are so placed that the valves open gradually, so that it is possible to have a valve in a position intermediate between open and closed.

In all these types, it is necessary to see that all levers and connecting rods are accurately in line and do not bind in any way in the joints. Any such friction will cause lag in the regulation.

In the hydraulic type, it is especially important to see that pilot valve moves very freely.

The limit of load which it is safe to carry on any electrical generator is dependent upon temperature. High temperatures lead to rapid deterioration of insulation, resulting in burn out of armature. Particular care should, therefore, be exercised in seeing that air around unit is not stagnant, but that a fresh current is constantly supplied from exterior sources, in order that heat may be dissipated. It is very essential to see that the air ducts are kept

open and that windings and ducts are kept free of oil. The guarantees on generator temperatures are always given for a definite rise above specific room temperature, usually 25 deg. C. Whenever a turbo generator is so located that a constant supply of cool fresh air is not available, special attention should be given to generator temperature. The actual operating temperature should be given the preference in consideration, rather than the total rise guaranteed.

The oil piping and filters should always be so laid out as to provide ample carrying capacity, sufficient drop being provided that oil readily drains away; be careful to see that no air pockets are formed in piping. Accumulation of air in pumps always leads to unsatisfactory operation.

To produce the highest efficiency of a turbine, the engineer should exercise the greatest care in getting the highest possible vacuum, carefully guarding against small leaks, which may appear trivial. To illustrate this point, if steam is worked from an initial pressure of about 175 lb. gauge to a vacuum of 28 1-2 in., the energy available is 5 per cent. more than it would be if a vacuum of 28 in. were used, and of this theoretical gain a large proportion is realized in the Curtis turbine, the net gain by such an increase of vacuum being from .5 to .6 lb. per kilowatt hour.

Experience in the setting up and operation of turbines shows that many so-called troubles have arisen from a lack of confidence on the part of the operating engineer. This lack of confidence is due primarily to the fact that these engineers have failed to familiarize themselves with the principles of turbines and with the details of the specific turbine they are to operate, and to the fact that they look upon the turbine as a mysterious and complicated mechanism that is supposed to take care of itself.

If the same intelligent study were given to the operation of the turbine that is given to the reciprocating engine, and if the operating engineer would make himself familiar with its details to the same degree, he would find it an extremely simple mechanism, and many of the difficulties experienced would be eliminated.

The various features which have been touched upon in this article are all explained in detail in the various pamphlets and instruction books issued by the General Electric Co., which will be willingly supplied to authorized persons asking for them.

ELECTRICAL ILLUMINATION OF SEATTLE DURING THE VISIT OF THE ATLANTIC BATTLESHIP FLEET

By W. G. GRAMBS.*

On schedule time, at precisely 2 p. m., May 23rd, the Atlantic battleship fleet steamed into the harbor of Seattle, and dropped anchor in line extending along the entire water front of the city. The sight was an inspiring one, and with the streets and buildings profusely decorated with the national colors and the thousands of people occupying every vantage point from which to view the magnificent sight, Seattle truly earned her title of the Queen City of the Northwest. As the sun set behind the Olympic Mountains and the electric lights commenced to be switched on, the real beauty of the picture became apparent.

Along the principal streets of the city and in line with the curb, strings of incandescent electric lights had been strung—the lamps being spaced at intervals of three feet and alternating in colors in sets of ten lamps in red, white and blue. In Pioneer Place the totem pole was festooned from its top to the marginal line of the triangle near the sidewalk with strings of lamps, also in the national colors, giving the effect of an immense cone when the lamps were lighted. Twelve large electric signs with letters ten feet high spelling the word “WELCOME” were arranged on the tops of the sky scrapers and along the sky line of the city. The Municipal and Seattle & Tacoma Power Companies’ sub stations, which are located on a hill overlooking the harbor and the city, were outlined in a beautiful and complete manner with incandescent lamps; while the Seattle & Tacoma Power Company, in addition to the incandescents, arranged four Glower Nernst Lamps at intervals around the top of its sub-station, producing a very beautiful effect in connection with the incandescent outlining. The Union railway station had two large American flags 10x25 feet worked out in colored lamps on the face of the station tower, and just below the flags large anchors 15 feet long.

Down town in the business section many of the business

*Contract agent Seattle Electric Company.



houses made lavish display of electric lights on the outside of their buildings. The Seattle Electric Company contributed toward the display a battleship thirty feet long, swung across the street sixty feet above the ground in front of its city office. The ship was constructed of sheet iron and was worked out in great detail, so that its appearance by daylight was almost as good a representation of a battleship as at night when illuminated. The vessel was dressed with flags of the international code spelling the word "Welcome," and over the battleship and to one side was a welcome sign made with Federal Electric sign letters. The hull, superstructure, smoke pipes, fighting masts and rigging were outlined with four candle power lamps. The effect at night was most beautiful, a perfect picture of an American battleship. Forward on the superstructure, where the saluting battery is usually carried, were arranged 42 saluting guns, enough for two national salutes. These batteries consisted of three ampere fuse plugs screwed into an ordinary lamp receptacle. The plugs were filled with black powder, a thin film of mica placed on top of the plug, the brass cap screwed on, and the plug dipped in melted fixture wax to make it impervious to moisture. After the plug was screwed into the receptacle, the whole arrangement was wrapped with tape. The battery was wired on two common returns and twenty-one lead-in wires, carried in a cable to the top of the Rainier Grand Hotel and connected up to a plug-in switch board. The fact that only a few of the charges missed fire speaks well for the moisture proof arrangement that was adopted, as the battery was exposed to several severe rain storms.

Tuesday, May 26th, as the parade was passing, and just as the head of the column of sailors approached the miniature ship, a national salute of twenty-one guns was fired; at the crack of the first gun a large 30 foot flag unfurled from above the ship, which was accomplished by pulling strings. On the roof of the hotel building a large yacht saluting cannon had been provided, and this gun was discharged simultaneously with the discharge of the powder charge from the battleship, by electricity, the effect being so perfect that few people discovered the ruse.

The electrical illumination of Seattle was highly complimented by the navy and strangers in the city who had seen the illuminations in other coast cities. The extensive decorations of the buildings with the national colors, combined with the large number of electric signs and special electrical illuminations, produced a picture difficult to surpass.

THE MINNEAPOLIS ELECTRIC CLUB

By H. G. WINSOR.*

An important matter for the management of a lighting company to consider is its relations with the municipal authorities, and with the electrical engineers, contractors and architects of the city or district in which the company is located. If the interests represented by these different parties can be considered and discussed together, and an understanding arrived at by a "get together policy," great benefit to everybody concerned must be the result.

We have in Minneapolis an example of what can be done along these lines; and the readers of the Journal may be interested in knowing what has been accomplished and how it has been brought about.

On March 3rd, 1907, representatives of the city electrical inspector's office, The Minneapolis General Electric Co., and the contractors, held a meeting and decided to proceed with the formation of an organization, the object of which should be to promote closer relations between the different electrical interests in Minneapolis, to create a better feeling among all parties, and to provide for the presentation and discussion of subjects of interest. On April 6th, 1907, another meeting was held, an organization formed, and temporary officers elected. On May 10th, by-laws were adopted and the organization was perfected, twenty-one members being admitted.

Meetings have been held each month since, with the exceptions of October and November, the first five meetings occurring in the county commissioners' rooms at the Court House, and later meetings in the assembly rooms of The Minneapolis General Electric Co., the company donating the use of rooms. At these meetings the following topics have been presented:

Grounds and methods of grounding; inspection; the neutral wire—its function and size; wire insulation; thermal primary bat-

*Chief Inspector Minneapolis General Electric Co.

tery; illuminating engineering; recent types of lamps; construction and use of electric meters; various types of generators and their operation; the automatic telephone; various types of induction motors; machine design; the use of electric light for the growth of plant life; joint pole lines; wireless telegraphy; wireless telephony; multiplex telegraphy.

All of these subjects were presented by able men and discussed, in some instances the discussion being quite spirited as well as thorough.

These discussions have been exceedingly interesting and instructive to the club members, and as a result we find the attendance increasing—at the last three meetings the attendance averaged about seventy-five.

The club also has an annual picnic, which last year was at Taylor's Falls, and an annual banquet. The banquet this year was held at Dayton's tea rooms on March 17th and was attended by one hundred and eighty persons interested in the electrical industry, city officials, etc. Mr. H. J. Gille, contract agent of The Minneapolis General Electric Company, acted as toastmaster.

It is of especial value to the operating department of a central station company to have its officers in close touch with both the city authorities and the contractors: personal contact in a semi-official way at the club meetings, together with the good fellowship among members during the social hour following, will surely afford the means to bring about this result.

A particularly interesting thing in connection with the club meetings is the manner in which matters of mutual interest are handled. For instance, the city electrical inspector gives notice that it is his intention to make a change in the city ordinance governing the installation and use of wiring and appliances, and explains his reasons for this action; he then invites discussion and criticism. The Minneapolis General Electric Company gives notice that it has under consideration certain matters which will affect the contractors; a representative explains the proposition in detail and gives reasons why action along lines suggested are necessary. All present are then invited to discuss the matter if they so desire.

The contractors are not forgotten, as they are invited to make known any grievance which they have, and when such is presented it becomes a subject for general discussion. Journeymen are also invited to ask questions on any subject pertaining to the work which they are called upon to do.

'These discussions bring the different interests closer together, and a thorough understanding is always possible; a misunderstanding often causes unjust criticism, if nothing more serious. There is no doubt of the value of such an organization; from the central station company's standpoint, it certainly affords a means of bringing about desired results.

As The Minneapolis General Electric Company donates the use of rooms for the club's monthly meetings, there is very little expense for the organization to meet; consequently the dues of the members are at present only 50 cents per year.

If any of the Journal's readers are interested, the writer will be pleased, on request, to forward copy of by-laws and any further information desired.

News from the Companies

BOSTON OFFICE.

Tampa Electric Company has sold to a syndicate composed of Messrs. Redmond & Company, of New York, Messrs. Warner, Tucker & Company, of Boston, and Stone & Webster, \$600,000, first mortgage 5 per cent. bonds, due June 1, 1933. These bonds were offered publicly on June 9th, at 93 $\frac{1}{4}$ and interest, at which price the yield is exactly 5 $\frac{1}{2}$ per cent.

The bonds are an absolute first mortgage on the company's entire property, consisting of 41 miles of street railway, equipment, etc., and a complete electric lighting system.

Since the company was organized in the fall of 1899, the net earnings have averaged yearly over four times the amount required for the interest charges on the above issue of bonds. For the 12 months ending April 30, 1908, net earnings were four and three-quarters times the interest charges on these bonds.

Although, during the past two weeks, there has been a falling off in the demand for bonds, the Tampa bonds have been in good demand, as their unusual strength has appealed to many investors.

The bonds are issued in denominations of \$500 and \$1,000, with the privilege of registration as to principal, and company receipts are being delivered pending the engraving of the definitive bonds.

Mr. W. B. Stephens, formerly in charge of the mailing department, has left Stone & Webster to catalogue the accumulated records of the Boston Consolidated Gas Companies.

L. H. Parker of the Engineering Corporation attended the Master Mechanics and Master Car Builders Convention at Atlantic City June 18th and 19th.

Mr. Walter Goodenough returned June 13th from an extended trip through the Southeastern district. At Tampa, his attention was devoted to investigations for the betterment of power sation operation and to conference on fuel contract. At Pensacola an

examination was made of the power and fuel situation. An investigation of Alabama coals in reference to their use on Southeastern properties was made at Birmingham, Ala.

Mr. Barrett Smith has been engaged to take charge of the publicity interests of the Corporation, and is now occupied with the formation of a publicity policy suitable for the interests of the organization. Mr. Smith is an engineer by education and training, and a writer for both the engineering and popular press.

Mr. L. H. Parker, railway engineer of the Stone & Webster Engineering Corporation, addressed the Chamber of Commerce, Chattanooga, Tenn., on June 11th, on the subject of "Interurban Possibilities."

During his short stay in Chattanooga Mr. Parker made a preliminary investigation of several interurban projects, radiating from Chattanooga.

The marriage of Mr. Herbert S. Whiton, manager Ponce Railway & Light Co., and Miss Edith H. Wyer occurred on Saturday, June 20, at Nantucket, Mass.

PAWTUCKET, R. I.

Mr. Orin Smith, Jr., has resigned as manager of the Pawtucket Electric Company and Mr. William McGregor, manager of the Pawtucket Gas Company, has been appointed manager of the Pawtucket Electric Company. Mr. McGregor will thus have full charge of both gas and electric lighting in Pawtucket.

Mr. William Buttrick has been appointed Superintendent of the Pawtucket Electric Company.

COLUMBUS, GA.

The city of Columbus has reason to congratulate itself upon the small amount of damage done by the cyclone and flood which visited it the latter part of April. Early on the morning of Saturday, April 25th, a cyclone traveling in a northeasterly direction passed just north of the city doing great damage to the timber land in the vicinity of the old Clapp factory. The path of the storm is readily traced as it comes over the hills on the Alabama shore, crosses the river and goes up the Georgia side, by a strip varying in width from a hundred and fifty to two hundred feet, in which no large trees are left standing. The tall pines were either uprooted or snapped off ten to twenty feet from the ground.

Our power house at North Highlands narrowly escaped the

storm. Here several windows were blown in and a water pipe leading from the gutter on the Bibb mill was blown away.

The old pavilion at North Highlands Park, which was at one time operated by the company, was completely destroyed. At the time of the disaster, it was occupied by a family, two of whom were killed. A quarter of a mile of our trolley on the North Highlands line and a few pole lengths in Girard were torn down by the falling trees and the wind. Our line crew, however, quickly repaired this and on Sunday cars were running on all lines.

This cyclone did great damage in Mississippi and Alabama before striking Georgia and continued on past Columbus, crossing the line of the Central of Georgia Railroad several times, notably at Chipley, Ga., where great damage was done. This cyclone was of terrific violence and caused such disaster as to be reported in the newspapers all over the world.

After the cyclone had passed, and not directly connected with it, heavy rains commenced. Due to twelve hours continuous rain on Sunday, in which three and one-half inches of water fell, the river rose rapidly and at five o'clock Monday morning it reached a maximum height of about 14 feet over the crest of our dam at the North Highlands station. During this time the river below the dam rose 44 feet, coming up within three feet of the floor of the Dillingham street wagon bridge. The water rose eighteen inches over the floor in the City Mills plant, causing this station to shut down.

In the new steam plant the water rose $11\frac{1}{4}$ inches over the floor of the engine room, filling the pits containing the drips and pumps operated in connection with the Curtis turbine. The water also stopped the motor generator which supplies the railway current, so that no cars were run on Monday until 7 p. m., when the river had fallen sufficiently for one of the generators at the City mills plant to be put into operation. The arc lamps were lit within an hour of scheduled time.

Several auction sales of land have taken place in Columbus this spring. Among them was one at North Highlands near the site of the proposed public park. The sale was reported a great success, one of its features being the giving away of one good lot as a prize.

The real estate agents of Columbus report much building in progress, especially residences. They say that activity in this line is greater this spring than a year ago.

The enforcement of prohibition laws in Georgia is proving interesting. Many cases of arrest, as the result of operating so-called "blind tigers," have been reported recently. One of the great difficulties in enforcing temperance in Columbus lies in the fact that this city is in such easy communication with the towns of Girard and Phenix City, in Alabama. Although prohibition laws are on the books in these places, the enforcement of them comes upon the Alabama authorities rather than those of Georgia. The result is that some of the people of Georgia are apt to avail themselves of any laxity which there may be in the enforcement of the Alabama laws.

Much interest is being manifested in the digging of artesian wells for a contemplated water supply by the city of Columbus. It is reported that nine wells are now nearing completion and that water will be pumped from them at an early date. The city has not as yet straightened out its legal complications with reference to the water supply question, and is not provided with a system of distributing mains; so that this water cannot be utilized at the present time. Owing to certain injunctions against the city's building a competitive water supply system until after it has purchased the property of the existing water company, it may be difficult to arrive at an early adjustment of the water question, although it is hoped that the final outcome will be satisfactory and will be amicably reached.

From May 2nd to 8th, Mr. Bleecker was visiting Paducah on legal business in connection with that company, and on May 18th he went to Savannah and Atlanta on business in connection with the Columbus companies.

General Superintendent C. M. Young left on May 17th for Chicago, where he attended the National Electric Light Association convention, and from there took a short trip to Minneapolis to study decorative and other lighting.

On May 20th Mr. Philip of the Engineering Corporation arrived in Columbus for some expert investigations, and it is hoped that he will be with us for some time.

Mr. M. D. Dexter, superintendent of the gas light company, attended a meeting in Atlanta on May 18th, where there was organized the Southern Gas Association. The objects of the Association, as expressed in the constitution, are as follows:

First, The promotion and advancement of knowledge, scientific

and practical, in all matters relating to construction and management of gas works, and the manufacture, distribution and consumption of gas.

Second, The establishment and maintenance of a spirit of fraternity among the members of the association, and ideas on the before mentioned subject matters.

Third, The inducement and extension of friendly relations between the manufacturers of gas and their patrons, based on the mutuality of their interest.

The following officers were elected: President, Mr. T. D. Miller, New Orleans, La.; Vice-President, Mr. R. C. Congdon, Atlanta, Ga.; Secretary-Treasurer, Mr. Jas. Ferrier, Rome, Ga.

(Herbert M. Corse.)

TAMPA, FLA.

A wireless telegraph station is to be located near our Ballast Point park. All of the apparatus is here, the site selected, and the work of erection will begin within a short time.

The Government has approved, and will soon advertise for bids for the erection of a number of buildings at Fort DeSoto on Egmont Key at the mouth of the bay, these improvements to cost \$100,000. One of the buildings is to be a gymnasium which will be fully equipped and cost \$10,000. The Government is constantly adding to the fortifications at both Fort Dade and Fort DeSoto, and also putting in many improvements looking to the comfort of the soldiers stationed at the Keys.

The first steamer of the Mallory Line (which abandoned the port of Brunswick, Georgia, to come into Tampa with a service direct from New York) will arrive at the city docks on June 25th, using our recently completed twenty-foot channel from the mouth of the bay to the south shore of the city. The wharves and temporary warehouses are now being built for the line, and these will be located along the channel between the mainland and Grassy Island, where the Seaboard Air Line terminals are to be constructed, the Mallory Line docks extending for seven hundred feet along the channel. It is planned to celebrate the arrival of the first steamer in a befitting manner, as everyone here realizes the importance of direct water communication with New York City. In connection with its New York steamers, the Mallory Line also expects to place small boats between Tampa and Fort Myers, Tampa and St. Petersburg and the Manatee River section, to act as feeders for the New York vessels.

The eighth annual picnic of the Tampa Electric Benefit Association was held May 13th at Ballast Point. While the attendance was not as great as at former affairs of the Association, due to a combination of circumstances, including the lack of an amusement fund in the average family this year, we shall net in the neighborhood of \$150 from the sale of tickets, etc. The program, which was just as entertaining and varied as in former years, was carried out with characteristic smoothness by Messrs. Fletcher, Johnson, Jones, Cato and Warfield of the program committee.

The special features this year were the awarding of a four-thousand mile ticket book, or one hundred dollars in cash, as might be preferred, to the holder of the lucky ticket, which was drawn for at the office of the "Tribune"; the free theatrical performance of the Gagnon-Pollock Company at the Casino in the grounds; the giving of \$15, \$10 and \$5 prizes to the members of the Association selling the most tickets; the presentation of a six-months pass to one of the principal moving picture theatres in the city to the person guessing closest to the number of people in attendance at the picnic; the awarding of a \$15 clock, which had been wound up several days before the picnic, to the person guessing nearest to the time it would stop; the hiding of some cash prizes in the sand on the shore to go to the person digging them up; and last, but not least, making glad the hearts of the children of the Orphans' Home by a trolley ride to the picnic, and all the attention and good things that go to make up an occasion remembered long after childhood has passed.

Tampa has just passed through her biennial political struggle—state, county and city officers being voted for. In this state the May primaries of the Democratic party really decide the election, as the number of Republicans in the state is so small as to make the November election merely a confirmation of the candidate nominated by the Democrats.

The municipal contest resulted in the election of ex-Mayor Frank L. Wing over Mayor W. H. Frecker by a majority of 123. A large number of the officers elected two years ago were candidates this year, but, with but few exceptions, they were defeated. The officials elected are all prominent men in this community, conservative in their views and practical in their business methods.

Mr. W. Goodenough, of the Engineering Corporation, made us a return visit of several days in June, to go more particularly into the question of our supply of fuel for the coming year.

PENSACOLA, FLA.

Mr. E. S. Roberts, contract agent, attended the N. E. L. A. in Chicago recently.

During the early part of April Mr. Walter Goodenough and Mr. E. B. Powell paid the company a visit in connection with expert work in the engineering department, Mr. Goodenough returning again for a few days the latter part of May.

The protracted visit of Messrs. H. H. Hunt, district manager, C. F. Wallace of Boston and Mr. George J. Baldwin, president, during the strike was of great benefit to the company's office force, giving them an unusual opportunity to become acquainted with their superior officers.

The central station has suffered much during the past month from lightning. The severest electrical storms have visited the locality, and done much damage. The superintendent, Mr. E. G. Howard, has devoted a great deal of time and thought to protection against such storms, and is fast bringing about a change for the better.

Mr. O. J. Semmes, superintendent of transportation, has recently returned from Mobile, where he spent the past two months on sick leave. He is again in active service, and is reconstructing his department after its disorganization by the strike.

JACKSONVILLE, FLA.

Walter Goodenough of the engineering corporation spent several days in Jacksonville the latter part of May.

C. V. Cosby, superintendent of transportation, visited Pensacola on a business trip early in June.

Two and one-half miles of new 500,000 c. m. cable have been installed by the Jacksonville Electric Company to improve the service on the Phoenix Park line. This pleasure resort lies a considerable distance from the power house, and the current has been found to be insufficient at that point satisfactorily to operate the large number of cars which are simultaneously started on the inbound trip immediately after the theatre entertainment. This new installation has very materially improved the service.

The office force of this company entertained several of the men from the Savannah Electric Company on Sunday, June 7th. The visitors arrived early in the morning and spent the entire day with us. They expressed themselves as highly pleased with Jacksonville and its effective street car service.

Lester C. Stone of the Engineering Corporation, who has been in Jacksonville for about four months, left for Key West about the middle of June.

PADUCAH, KY.

The State Federation of Women's Clubs of Kentucky has just closed its fourteenth annual meeting in Paducah. There were a large number of club women present and many questions of interest were discussed. The visitors left Paducah enthusiastic over the manner in which they had been received.

Extensive preparations are being made for the Three States Travelling Men's Association, which is to meet here the first week in July. About two thousand men are expected to attend.

Several important accident cases were settled this month. One of them was rather unusual. A woman brought suit against the company claiming that the conductor left the car door open on a cold, rainy day, causing her to contract cold and fever which lasted several weeks. The judge ordered the suit dismissed on the motion of the company's attorney's that there was not sufficient cause for action.

Inspector J. E. Lawless, who has been with this company for the past five years, resigned the first of May to enter the employment of the Nashville, Chattanooga & St. Louis Railway.

The Paducah Light and Power Company was represented at the N. E. L. A. Convention in Chicago by its manager, Mr. F. E. Reidhead.

HOUGHTON COUNTY, MICH.

Upon the application of the Calumet and Lac la Belle Traction and Power Company, an order has been issued by Judge Loyal E. Knappen of the United States Court at Grand Rapids restraining The Houghton County Street Railway Company from building that part of its extension between Mohawk and Calumet which passes over land under condemnation. This order prevents the railway company from doing any work on the land that the Calumet and Lac la Belle Company seeks to have condemned for a right of way, but has not stopped work on the rest of the line.

Electric Park opened on May 31st with an afternoon concert by the Calumet and Hecla Band. Nearly one thousand people attended the opening. As in the past, the park will be reserved on certain days for private picnics and dances. Already quite a num-

ber of dates have been reserved ahead, and from the present outlook the season should be a prosperous one.

At Lansing on June 4th the Michigan state railroad commission held a conference with the managers and superintendents of the electric railways of this state, for the purpose of discussing the present system of train dispatching in use on the different roads. Several systems were discussed, with the idea of adopting a standard for all roads. The primary object is better to provide for the safety of the traveling public, by giving the train dispatchers closer control over the cars. No definite line of action was decided upon at this meeting.

Governor Warner of this state visited the Copper Country the first of the month. A large reception and ball were tendered to him by the naval reserves.

The Houghton companies are well represented in the military organizations of this district. Mr. F. H. Abbott, electrical engineer, has recently been appointed second lieutenant, and acts on the staff as commissary and quartermaster. Mr. B. L. Walsh, chief engineer for the railway company, is assistant engineer in the naval reserves. The lighting company is further represented by a sergeant in the militia company and an ordinary seaman in the naval reserves.

A new source of revenue has been discovered for the railway company, which may be of interest to other managers. In the main waiting room at Laurium has been placed a penny weighing-machine. The first of the month the people waiting for one of the cars were surprised by a man coming in with two freshly killed sheep over his shoulder. In a matter of fact way, he placed these on the scales and weighed them with the help of the usual penny.

On the Mohawk extension, the location survey has been entirely completed and about half of the road staked out ready for construction work. The grading across the Centennial property is finished, ready for the track work. Other sections of the work are rapidly reaching this same state of progress. Plans for a trestle over the Mineral Range at Kearsarge are now on the drafting table, this overhead crossing having been granted by the railroad commission. The greater part of the ties to be used in the construction are already on the ground, and the laying of the track should begin in the immediate future.

The first thunder-storm of the season passed over the northern end of the district about June 1st. The lighting company was not

affected. The railway, however, had three or four car motors burned out; also the series field on the auxiliary generator at the Lake Linden sub-station was grounded. Luckily the damage was light, and repairs can be made by the station force.

The Copper Country has been visited lately by the heads of some of the largest interests. Mr. Alexander Agassiz, president of the Calumet & Hecla mining company, accompanied by Quincy A. Shaw, Jr., second vice-president, spent a week or so inspecting their interests. Mr. William A. Paine, president of the Copper Range Consolidated mining company and the Copper Range railroad, and R. T. McKeever, vice-president and manager of the railroad, will be here about ten days on their regular spring visit.

The railway company has considerable work on hand this summer. The new coal handling plant at Hancock is well under way. Paving in Laurium will be started this month; considerable work will likewise be done in the repairing of the pavement in Hancock. The trestles on the main line between Calumet and Houghton are also being thoroughly overhauled and new timbers put in where necessary. This season promises to be a busy one for all hands.

MINNEAPOLIS, MINN.

The excessive rains throughout the middle Northwest have resulted in a very high stage of the St. Croix River, on which the large hydro-electro plant of The Minneapolis General Electric Company is situated. The river is within five or six feet of the high water mark of 1881, the highest in its history. Over the spillway, which is 740 feet long, there is six feet of water flowing at the present time. In the lower flowage land of the river, just above the power station, there are over 8,000,000 feet of logs ready to be sent down through the sluiceway to Stillwater, where they are sawed up into lumber. At the present time, however, it would not be good policy to sluice these, as many would be left stranded on the banks as the river receded.

On May 21st pole No. 1359 on the Minneapolis-St. Croix transmission line was struck by lightning, breaking an insulator and setting the pole on fire. No interruption to service followed, as the generators at Main Street carried the load.

Messrs. Gille, Rogers, Miley and Clark attended the National Electric Light Convention. A very profitable week was spent by all.

Fine fishing is reported on the St. Croix River—and vicinity.

Small mouth black bass and brook trout seem to give the greatest sport.

For the purpose of displaying more effectually the various uses to which Tungsten lamps may be put, a dark booth has been made in the demonstration department. As this booth is near the cashier's cage, the attention of customers is often attracted to it when they enter the office to pay their lighting bills.

Mr. A. J. Veitch visited us on June 8th, 9th and 10th from the Chicago office.

A new Westinghouse metallic flame arc lamp has been on test in a very conspicuous location near our office building for the past month, and has caused much favorable comment. The lamp is the result of experiments with a view of increased efficiency and reduced cost of maintenance. Distribution of light is uniform and no shadow is cast on the street below; the complicated system of up-feed is substituted by a more simple form of down feed. A draft system which carries away all deposits in the bottom of the globe is another good feature of this lamp. These lamps are burned on a D. C. series system, and are wired from an Edison underground system, which supplies the entire business district of the city. With an idea of changing to a more modern form of street illumination, these lamps appear very satisfactorily to meet the requirements.

Forest Amusement Park, a new park just in process of construction, is exciting considerable interest throughout the city. One of the great attractions is the "Electric Fountain." This park adds a connected load of 60 kilowatts to our Columbia Heights feeders.

On June 20th the new ornamental street lighting system was switched on for the first time. A very pleasing effect was witnessed, and the policy of taking down all overhanging signs which interfere with uniformity of the system helped much to increase its effectiveness.

Seven and a half miles of overhead grounded wire, used for lightning protection on the transmission line, have already been installed this season. There still remain seven and a half miles to be installed. It has been found necessary to protect this line, more particularly on the unprotected heights and on the swampy lands.

At the Elm Street sub-station, the lightning protection was destroyed by a severe storm of May 29th. No damage was done to the transformers, and on the next day new arresters were installed.

On the Lake Harriet ornamental lighting system, recently installed for the park department, it was found advisable to install one 100 watt Tungsten on each post, instead of the 60 watt, and to do away with the holophane special distributing globes, leaving a 14-inch light alabaster globe to protect the lamp. The present arrangement is proving very satisfactory.

The 60 watt Tungstens in clusters, placed inside of diffusers, are meeting with much favor for interior illumination—especially for replacing gas arcs. The four 60-watt Tungsten group with plain glass globe and large reflector is the most effective light for lighting alleyways, etc.

(B. M. McGrath.)

BELLINGHAM, WASH.

On the 21st and 22nd of May seven of the battleships of the Atlantic fleet, the "Connecticut," "Georgia," "Rhode Island," "Kansas," "Minnesota," "New Jersey," and "Vermont," were guests of this city. During the two days and nights that the ships were here every minute of the time was devoted to the pleasure and entertainment of the officers and crew. Thursday night the officers were given receptions by the "Cougar," "Kulshan" and "Elks" clubs, while the blue jackets were in attendance *en masse* at a ball given by the city. Early Thursday morning special trains from British Columbia and neighboring towns began to arrive, bringing great crowds of excited people to enjoy the great naval display. There were approximately 30,000 visitors in the city that day and the railroads were forced to press flat cars and cabooses into service to handle the crowd. The most attractive and inspiring feature of the day was a parade, consisting of the local militia company and about 2,000 blue jackets and marines, headed by Rear Admiral Sperry and staff in company with prominent local men in automobiles. The rest of the day was spent in visiting the amusement resorts and battleships. It is estimated that 25,000 people went aboard the various ships, the flagship Connecticut being the favorite. From 8.30 till 10 o'clock each evening the battleships were beautifully illuminated with incandescent festoons that outlined the hulls, bridges and funnels so distinctly that they seemed like ships of light rather than of iron and steel. Each ship was equipped with five searchlights, which played on homes, mountains and clouds. Our company illuminated the wharves, docks, streets and public buildings with incandescent and arc lamps to such an extent that there was no part of the business district

that was not ablaze with light. Friday evening the officers were the guests of the city at a ball given in their honor. The hall was decorated with red, white and blue, and that combined with the beautiful gowns and smart naval uniforms made a picture not soon forgotten.

Anyone who witnessed the arrival of the fleet could not help being impressed with the wonderful harbor facilities of this city. The boats swung around Eliza Island, nine miles south, into Bellingham Bay in single file. They then began manoeuvres that quickly placed them in two lines about 200 yards apart, one line being headed by the flagship. From the vantage point of Sehome Hill it was perfectly evident that seven or eight more similar lines, and five miles long, could have steamed into the bay without any difficulty. At any point anchors could have been dropped by all of the ships into the perfect security of soft blue mud. The officers and men were highly pleased with their reception here and, like Admiral Sperry, wished that they had "known about this country twenty years ago."

One of the best results of the visit of a portion of the Atlantic fleet to Bellingham has been the gratifying publicity given the city. The fruit of our entertainment to the fleet is already beginning to ripen. There were several representatives of eastern newspapers here, among them Mr. R. H. Patchin, of the New York Herald. Mr. Patchin accompanied the fleet on its trip around South America and intends to remain with it during the entire cruise. In the New York Herald of May 22, which arrived in this city yesterday, he has given Bellingham a large amount of enviable and pleasant notoriety. He gives the population at between 30,000 and 40,000, which is near enough; pays a tribute to the lumbering and fishing industries; says "the harbor is beautifully surrounded by wooded hills, and the scenery, while not so rugged, is more attractive by far than the Strait of Magellan." He also speaks of the excellent anchorage.

Mr. Shuffleton, of the Stone & Webster Engineering Corporation, is now spending most of his time in Seattle, working on the White River power plant development. The Bellingham office has been closed temporarily, and Mr. Roberts has gone to his home in Detroit, Michigan, to spend the summer. Mr. J. K. L. Ross is still at work securing rights of way for the proposed interurban into Skagit County, this work being well on the way towards completion.

At a meeting of the members of the Cougar Club on May 11th Mr. L. H. Bean was elected president; Mr. E. B. Deming, vice-president; and Mr. Bruce Farris, secretary.

On the 5th of May Mr. Grant and Mr. Lukes were in the city on company business.

Mr. Robert Clark, superintendent of the gas department, returned recently from a five weeks' visit with friends and relatives in Massachusetts and Vermont. While there he visited several gas plants and spent two days in the company of Mr. Shiebler of the Engineering Corporation, talking over plans for changes in the local plant.

Mr. Titcomb, chief engineer, and R. P. Martin, station electrician, have just completed the successful installation of a new 500 Kw. General Electric motor generator set. Several new panels have been added to the switchboard and permanent 1,500,000 C. M. cables installed.

(L. R. Coffin.)

SEATTLE, WASH.

On May 24th Mr. H. F. Grant, district manager, left for Boston to take up a number of important matters connected with the operations of the companies in the Puget Sound district.

President Furth gave an informal dinner at the Butler Hotel on the evening of May 21st, at which the district manager, the managers of the Puget Sound companies and the department heads of the Seattle Electric Co., were present. The dinner was a great success and the evening was thoroughly enjoyed by all present.

Mr. W. E. Wilmot, auditor, and Mr. A. L. Snyder, electrical and mechanical engineer, attended the N. E. L. A. Convention at Chicago as delegates from The Seattle Electric Co. They returned via Denver and Salt Lake City, having had a very pleasant and profitable trip.

The great event of the month was the visit of the Atlantic fleet to Puget Sound waters. During the four days of the fleet's visit to Seattle the officers and sailors were entertained at a round of festivities, the most prominent of which were the reception to the officers at the new Washington Hotel on Saturday evening, May 23rd, the barbecue for the sailors at Woodland Park the following Monday afternoon, and the ball for the junior officers on Tuesday night. Visitors from the surrounding country began pouring into the city a week ahead of the big event, and it is estimated that nearly half a million people witnessed the arrival of the

fleet. A most inspiring spectacle was the parade of the sailors of the fleet and the soldiers from neighboring forts. They were cheered along the route by thousands of spectators, who thronged the streets and every available vantage point. The visit of the fleet resulted in the four heaviest days of travel in the history of the company, nearly a million and a half passengers being carried during this period. The heaviest day was that of the arrival, when over 45,000 passengers were carried. Remarkable to relate, not a single serious accident happened, a fact which was the occasion of much favorable comment. This was due, in large measure, to the efficient work on the part of the trainmen, inspectors and the city police department.

A bureau of publicity has been organized in connection with The Seattle Electric Co., for the purpose of encouraging friendly feelings between the press, the public and the company. An effort will be made by means of pamphlets, bulletins and special articles in the newspapers to stimulate pleasure travel during the time of day of lightest load. Under the caption of "What to See and How to See It," a folder descriptive of various points of interest reached by the lines of the company has been published and distributed gratis at the hotels, news-stands, etc., for the use of visitors in the city. These folders have met with ready favor, and other folders and pamphlets of a similar nature will be published from time to time. Special cars, known as "sight-seeing" cars, have been scheduled to run daily on various routes, making interesting and inexpensive trips for strangers who have but a limited time to visit the places of interest and view the vast improvement work in progress in the city. Mr. J. W. McCloy, formerly of the transportation department, is in charge of this department.

Mr. Gardner F. Wells, from Boston, has recently arrived in Seattle, and is making a special investigation as to the causes of accidents in this community. Mr. Wells has spent considerable time studying the method of preventing accidents and handling claims and adjusting the same. The conditions in Seattle in the past have been such that the company has been to heavy expense on account of damage cases, and we gladly welcome Mr. Wells to this field, feeling assured that his experience in such investigations will produce beneficial results, and enable this company to minimize the amount of money necessarily spent for damages.

TACOMA, WASH.

For the past six weeks the weather at Puget Sound has been

such as to impair the gross earnings of our railways. It has been cloudy, rainy and chilly, and for the time being pleasure riding has practically been abandoned. Generally during the latter part of April and through the month of May the conditions are such as to cause a great deal of travel.

The Atlantic battleship fleet reached Puget Sound Saturday, May 23rd, anchoring opposite Seattle. That city had very greatly decorated itself in the way of flags, bunting and night illuminations, and immediately travel from the south over the Interurban between Seattle and Tacoma began to increase. Earnings went up to high water mark, some 15,000 people being handled upon this line in one day. The fleet arrived in Commencement Bay at Tacoma on Wednesday, May 27th, when the travel from Seattle started southbound over the Interurban, again and swelling our revenues, while the surrounding country south of Tacoma was practically depopulated, everyone coming into the city to witness the battleships parade in the harbor. Part of the ships left for San Francisco, and part dropped anchor here until Sunday, May 30th.

During this period Tacoma was in holiday attire. All the buildings were decorated, many of them being absolutely covered with electric light bulbs. The high brick stack of the Tacoma Railway & Power Company, which is located almost in the heart of the business district, and which is of hexagon shape, was decorated with white electric bulbs from top to bottom. This stack could be seen from every point around Commencement Bay and from the battleships lying in the harbor, and the captains of the different vessels stated that it was one of the prettiest sights they had ever seen. The stack looked, they said, like a lighthouse constructed for their benefit; the lights falling from the top gave it the appearance of a huge waterfall—in other words, they looked like water rippling over the top. This idea was suggested and carried out by Mr. K. C. Schluss, our superintendent of power. The chamber of commerce and other public bodies of the city have expressed great appreciation of our endeavor to assist in properly decorating Tacoma.

Free rides were furnished for numbers of the sailors, who had been entertained during their trip until, as they stated, they were practically "all in" so far as water amusements were concerned; consequently, they seemed to get a good deal of enjoyment from riding out on our suburban lines, picnics being held for their special benefit. The officers were entertained at the clubs and resi-

dences of prominent citizens. On the last evening a dance, with an entertainment, was given at the Country Club at American Lake, thirteen miles from the city. On the trip to and from the lake Admiral Wainwright and the captains of the battleships were the guests of the writer in the private car "Tacoma."

It is our opinion, from conversations at the clubs and in public places, that the visit of the fleet has done more to bring the Puget Sound district before the country at large than anything that has happened for years. We also believe that it will mark the beginning of heavier government expenditures for light houses and coast protection. Furthermore, it has attracted the attention of people who came from points in the interior as far east as St. Paul and Minneapolis to see the battleships, an opportunity they had never had heretofore. While making their visit these people became very much interested in the country, which will, it is expected, induce a certain percentage of them to locate in this new progressive western field.

The federal government has within the past week appropriated an additional \$50,000 toward the government road to Paradise Valley, at Mt. Tacoma, the mountain being some fifty miles south of this city. Before the summer is over it will be possible for an automobile to run from Tacoma to this point (which is 10,000 feet above sea level) over a smooth, beautiful roadway, which will not exceed a grade of four per cent, and land the passenger at the foot of a glacier between 1,000 and 1,500 feet high, composed of solid ice with crevices here and there; when the sun shines on it all colors of the rainbow are given out. It is the intention of the government to make Paradise Valley a government park along the lines adopted for Yellowstone, and we expect that within a few seasons there will be a regular tourist travel, just as there is to Yosemite Valley, Yellowstone, and other noted parks throughout the western country. This will have more or less of a tendency to bring Tacoma to the front, as the terminals of the Tacoma Eastern Railroad, which runs to Mt. Tacoma, are located in this city, to which everyone is compelled to resort when taking the trip.

The Chicago, Milwaukee & St. Paul is progressing quite fast with its new line, and we are in hopes that within another year through trains will be running between Chicago, Seattle and Tacoma, opening up new territories and advertising the cities on Puget Sound to an extent not heretofore witnessed.

(W. S. Dimmock.)

SYDNEY, CAPE BRETON.

Business conditions in the Maritime Provinces for the month of May, and the first half of June, continue to show some improvement over the corresponding period last year.

The writer has just returned from a trip to Montreal, Peterboro and Toronto, and finds that business in all industries is very quiet. It is only reasonable to expect that the present business conditions in Upper Canada and the States should react more or less on the Maritime Provinces.

It is already rumored that the Nova Scotia Steel & Coal Company, Limited, is to shut down its blast furnaces the middle of June, throwing about four hundred men out of employment. The consumption of coal in these furnaces is about six hundred tons per day, which represents the output of about two hundred men, engaged directly and indirectly in the handling and mining of this amount of coal. This means that the company will have to find a market for about two hundred tons of additional coal per day, or else curtail in their mining operations. This will effect the town of Sydney mines to a considerable extent, and also our North Sydney and Sydney mines division. The reason given by the steel company for the shut down is that it already has a large stock of pig iron and bars, which it can find no market for.

The Dominion Iron & Steel Company, we are advised, has sufficient orders on hand to keep the plant running full time until October.

(A. F. Townsend.)

PONCE, PORTO RICO.

More rain has fallen recently in the Ponce district than for some preceding months. Coming just at the planting season, it has caused the sugar planters to feel hopeful concerning next year's crop.

Business still continues very dull in the railway department, but holds up fairly well in the lighting. As yet we have had no competition from the kerosene vapor lamps that have made such inroads in Mayaguez. It may be that the poor service there is responsible for the non-success of this type of lamp, as it has not been very popular in San Juan. We hope to have no serious competition from it in Ponce, as our service is unusually good and the Gem lamps are pretty satisfactory. We have not yet tried the Tungsten lamp, as all freight receives rough handling in the lighters; we may, however, find it advisable soon to ship a few to see if they will stand the rough usage without undue breakage.

Mr. John H. Bissell has taken a position in our accounting department to fill the vacancy caused by the resignation of M. S. Callejo.

The writer had the pleasure of making a trip over the new Caguas extension of the San Juan Company on June 2d. The track, which is meter gauge with 3 per cent. maximum grade and 20 degree curves, follows a beautiful valley the greater portion of the way.

A short distance from Rio Piedras is a ledge which was thrust up through the soil by volcanic action and which is so thoroughly honeycombed as to form a very attractive grotto. It is intended to make a pleasure resort of this spot: it will undoubtedly be a popular one, as it is within easy reach of San Juan and is unique in its natural advantages.

The road will be operated by steam at present, but it is intended to lay standard gauge track later and use electric traction.

On June 3d the first freight was sent out to Caguas, and in the near future passenger service will be inaugurated.

(H. S. Whitton.)

QUOTATIONS

ON

SECURITIES OF PUBLIC SERVICE CORPORATIONS

UNDER THE MANAGEMENT OF

OUR ORGANIZATION

JUNE 20, 1908

NOTE:—Quotations are approximate. Unless indicated to the contrary Bonds and Notes are 5 per cent and preferred stocks 6 per cent non-cumulative. Accrued interest should be added to quotations on Bonds and Notes.

COMPANY	BONDS	PREF.	COM.
Blue Hill Street Railway Co., The	95	No pref.	....
Brockton & Plymouth St. Ry. Co.	93 ¹¹	No pref.	....
Cape Breton Electric Co., Ltd.	87½	75	15
Columbus Electric Co.	90	....	....
Columbus Power Co., The	95 Notes 95	....	....
Dallas Electric Corporation	7, 8 85	50 ³	15
Edison Elec. Ill. Co. of Brockton	105½ Notes 100	No pref.	151
Electric Light and Power Co. of Abington and Rockland	100	No pref.	150
El Paso Electric Co.	8 92½ Notes 96 ⁴	85	41
Fall River Gas Works Co.	No bonds	No pref.	230
Galveston Electric Co.	92½	....	....
Galveston-Houston Elec. Co.	....	81 ¹	25
Houghton County Elec. Lt. Co.	97	22½ ⁶	13 ⁸
Houghton County St. Ry. Co., The	92½	85	20
Houston Electric Co.	6, 7 98	....	....
Jacksonville Electric Co.	92½	95	80

COMPANY	BONDS	PREF.	OOM.
Key West Electric Co., The	....	....	....
Lowell Elec. Lt. Corporation, The	100	No pref.	185
Minneapolis General Elec. Co., The	98	105 ^{1, 6}	85 ⁶
Northern Texas Electric Co.	96 ²	83 ⁷	29 ⁷
Paducah Traction & Lt. Co. ⁷	80	50 ^{1, 3}	15
Pensacola Electric Co.	95	75 ¹	23
Ponce Electric Co.	100 ⁴	No pref.	....
Puget Sound Electric Railway	97	87	41
Notes, 1911	96		
Notes, 1912	95		
Puget Sound Power Co.	97	No pref.	....⁹
Savannah Electric Co. ^{6, 7}	80	50	12½
Seattle Electric Co., The	102 ^{6, 7, 8}	93 ^{6, 7, 8}	75 ^{6, 7, 8}
1st m'tge	102		
Consol. and Refund m'tge convertible	96		
" " " " non-con.	98½		
Notes	96¾		
Tacoma Railway & Power Co.	95	No pref.	....¹⁰
Tampa Electric Co.	93¼	No pref.	103¼
Whatcom County Ry. & Lt. Co.	92½	87 ¹	40

1.—Cumulative. 2.—Bonds of Northern Texas Traction Co. 3.—5 per cent. 4.—6 per cent. 5.—Par \$25. 6.—Listed Boston. 7.—Listed Louisville. 8.—Listed Columbus, Ohio. 9.—Held by The Seattle Electric Co. 10.—Held by Puget Sound Elec. Ry. 11.—4½ per cent.

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NOTE.—The Securities Department handles securities for those wishing to purchase or sell. Requests for information in regard to any of the above companies will be promptly answered at any time by this Department.

COUPONS AND DIVIDENDS DUE

	Per Cent
July 1st, Columbus Electric Company, preferred stock, 6 per cent	3
July 1st, Electric Light & Power Company of Abington & Rockland, The, stock, 8 per cent.....	4
July 1st, Puget Sound Electric Railway, preferred stock, 6 per cent	3
July 1st, Cape Breton Electric Company, Ltd., 5's, 1932...	2½
July 1st, El Paso Electric Company, 5's, 1932.....	2½
July 1st, Everett Water Company, 5's, 1921.....	2½
July 1st, Houghton County St. Ry. Co., The, 5's, 1920.....	2½
July 1st, Houghton County Electric Light Co., 5's, 1927....	2½
July 1st, Lowell Electric Light Corporation, The, 5's, 1914..	2½
July 1st, Savannah Electric Company, 5's, 1952.....	2½
July 13th, El Paso Electric Company, preferred stock, 6 per cent	3
July 15th, El Paso Electric Company, 6 per cent. coupon notes, 1913	3
Aug. 1st, Everett Railway, Light & Water Company, stock..	1
Aug. 1st, Fall River Gas Works Company, capital stock....	5
Aug. 1st, Houston Electric Company, preferred stock, 6 per cent	3
Aug. 1st, Jacksonville Electric Company, preferred stock, 6 per cent	3
Aug. 1st, Jacksonville Electric Company, common stock, 6 per cent	3
*Aug. 1st, Lowell Electric Light Corporation, the, capital stock, 8 per cent.....	2
Aug. 1st, Minneapolis General Electric Company, The, preferred stock, 6 per cent.....	3
Aug. 1st, Minneapolis General Electric Company, The, common stock, 4 per cent.....	2
Aug. 1st, Houston Electric Company, 5's, 1925.....	2½

Aug. 1st, Key West Electric Company, The, 5's, 1956.....	21½
Aug. 1st, Pensacola Electric Company, 5's, 1931.....	21½
Aug. 1st, Puget Sound Electric Railway, 5's, 1932.....	21½
Aug. 1st, Puget Sound Electric Railway, 5% notes, 1911....	21½
Aug. 1st, Puget Sound Electric Railway, 5% notes, 1912....	21½
Aug. 1st, Seattle Electric Company, The, First Mortgage 5's, 1930	21½
Aug. 1st, Seattle Electric Company, The, Consolidated and Refunding Mortgage 5's, 1929.....	21½
Aug. 1st, Seattle Electric Company, The, 5% notes, 1911..	21½

* (This dividend has been made payable quarterly.)

RECENT ADDITIONS TO THE LIBRARY

Attention is called to the following recent accessions to the Library:

"The New International Year Book," 1907 (Dodd, Mead & Company, N. Y. Cloth, \$5), deals with statistical and other matter of general interest, such as Canadian Pacific Railway projects; the panic; electrification of railways; progress of the United States; development of airships, etc., etc.

"The Year Book of Legislation" (issued by the New York State Library, Albany. Cloth, \$1), containing five bulletins under one cover, is an important annual for those interested in public service corporations. Franchises, municipal regulation, anti-trust laws, taxation, etc., for all the states, come within its scope.

The three-volume report on "Municipal and Private Operation of Public Utilities," 1907 (compiled and published by the National Civic Federation, 281 Fourth St., N. Y. Cloth, \$10), contains valuable data on appraisals, depreciation, factors determining the extent and location of extensions, consumption per capita of gas, water and electricity, and a vast number of other topics bearing directly or indirectly upon public service corporation interests.

"The Weathering of Coal," by S. W. Parr and N. D. Hamilton, 1907 (Bulletin 17, Engineering Experiment Station, University of Illinois, Urbana, Ill. Pamphlet, free), deals with the deterioration of coal in storage and the causes of spontaneous combustion. The matter is presented in tabular and graphic form, and the authors come to the conclusion that in most instances coal under cover suffers not less than that under the weather.

LIBRARY

OF

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Current Literature

Selections from Recent Magazines and Book Accessions.

Ed, *, and + are used in cases of magazines to indicate editorial, illustration, and map or diagram respectively. But these symbols do not have the same significance in the case of book numbers, all of which are preceded by an asterisk.

Constructional Materials. (See also 18)

- 1 Fractional experiments in steel for use in stm boilers, bridges, etc., to secure higher tensile strength & uniform quality of material. CLHuston. Jnl of Franklin Inst-5|08-371-13.5p*+
- 2 Methods for protecting iron & steel against corrosion: painting, galvanizing & the electrolytic process; 3 necessary conditions for protection of steel, isolation, insulation & immunization. GBHeckel & appendix with rept on tests of steel plates made to paint mfrs of U S. Jnl of Franklin Inst-6|08-449-18.5p*+

Water Supply. (See also 19-21, 23, 33-37)

- 3 Water rates charged in 375 cities. DRGwinn. Water & Gas Rev-5|08-20-3.5p+; El'l Wld-5|21|08-566-0.4p
- 4 Pumping statistics of mun & private plts & water works data of the same: kind & amt of fuel; cost of pumping; average consumption; distbtg systems; length of mains, etc. Mun Jnl & Egr-5|6|08-365-9p+

Lighting. (See also 22)

- 5 Economical aspects of various el illuminants. Costs of operating various multiple lps, etc. AAWohlauer. El'l Wld-5|16|08-1042-2p, 1007-0.4p(Ed)
- 6 Modern arc lps: the obsolescence of the carbon arc; "flaming" & "luminous" arcs compared. DrLouisBell. El'l Record-6|08-280-6.1p*

Plants and Stations and Dynamo Electric Machinery.

- 7 System & operating practice of Commonwealth Edison Co., Chicago, Ill: Fisk & Quarry St stations; cables & ducts; ac distbtg system; routine & emergency operation; training of operators; meter dept. El'l Wld-5|16|08-1023-21p*+, 1010-0.6p(Ed), Western Eln-5|16|08-378-8.5p*+; 390-0.5p(Ed)
- 8 Application of storage batteries to regulation of a-c systems. JLWoodbridge (AIEE, Atlantic City, NJ, 6|29-7|2|08). Procdgs Am Inst El'l Egrs-6|08-949-34p*+

- 9 Relative proportions of copper & iron in alternators: approximate method to determine the value of flux to give the cheapest machine. CJFechheimer (AIEE, Atlantic City, NJ, 6|29-7|2|08). Procdgs Am Inst El'l Egrs-6|08-985-25p+
- 10 High voltage measurements at Niagara: loss in relation to atmospheric conditions, insulation, & nature of conductors. Ralph DMershon (AIEE, Atlantic City, NJ, 6|29-7|2|08). Procdgs Am Inst El'l Egrs-6|08-1027-54.8p*+
- 11 Some egrg features of the Southern Pr Co's system: map of transmsn lines; wood pole lines vs steel towers; frequency; voltage; sub-stations; costs. JWFraser (AIEE, Atlantic City, NJ, 6|29-7|2|08). Procdgs Am Inst El'l Egrs-6|08-1085-21.5p*+
- 12 Measurements of ltng, aluminum ltng arresters, earth resistances, cement resistances & kindred tests: characteristics of ltng; frequency; observations on lines of Pueblo & Suburban Lt & Pr Co, Col, & The Animas Pr & Water Co. EEFCreighton (AIEE, Atlantic City, NJ, 6|29-7|2|08). Procdgs Am Inst Egrs-6|08-827-71.5p*+
- 13 Minimum work method for solution of a-c problems: simple transmsn circuit; capacity effect in a transmsn line; the a-c transformer; the induction motor. HaroldPender (AIEE, Atlantic City, 6|29-7|2|08). Procdgs Am Inst El'l Egrs-6|08-763-27p+

Steam Engineering. (See also 24-27)

- 14 Egrg practice as applied to the fueling equipmt of pr houses: conditions upon which type of mchy & method of handling depend; automatic feeding devices; capacity of flight conveyors; the Dodge system in storing anthracite coal. HPCochrane. Jrnl of Franklin Inst-6|08-401-24.5p*+
- 15 Furnace design in relation to fuel economy: boiler efficiency & ht losses; unburned gases & coal. EGBalley & disc. (Boston Soc Civil Egrs, 12|18|07). Jrnl Assn Egrg Soc-4|08-177-28p+
- 16 Stm turbines; classification; features to be attained; reduced steam consumption, increased peripheral speed, simplicity & accuracy; low pressure turbines. JNBalley. Elec Jrnl-6|08-305-12.5p*+, 302-0.6p(Ed)
- 17 Thermal properties of superhstd stm: tables & data in regard to specific ht. Procdgs Am Soc Mechl Egrs-6|08-533-22.5p+

Book Accessions.

- 18 Tests of reinforced concrete beams: series of 1905. ArthurNTalbot. Univ of Ill, Egrg Experiment Station, Bull No 4. 84 p, 6x9, illus. 1906. *.077. T14e
- 19 Summary of controlling factors of artesian flows. MyronLFuller. U S Geol Surv, Bull No 319. 44 p, 6x9, illus, 1908. *6874. B319
- 20 Current wheels: their use in lifting water for irrigation. Office of Experiment Stations, Bull No 146. 38 p, 6x9, illus, 1904. *6885. B146.
- 21 Water-works management & maintenance: sources of supply compared; pumping; reservoirs; operation; maintenance of quality; electrolysis; service required for fire protection; finance & accounting; franchises; rates. WinfredDHubbard & WynkoopKlersted. Ed, 1429 p, 6x9, illus, 1907. *076. H86
- 22 Comparative tests of carbon, metalized carbon & tantalum filament lps. THAmrine. Univ of Ill, Egrg Experiment Station, Bull No 19. 44 p, 6x9, illus, 1907. *07114.11 6
- 23 Taylors Falls (Minn) water pr develpmt. Dam & pr station recently built for Minneapolis Gen El Co. Stone & Webster Engrg Corp'n, Boston. 28 p, 10x7, illus. *4161.165
- 24 Fuel tests with ill coals. LBBreckenridge, SWParr, HBDirks. Univ of Ill, Egrg Experiment Station, Bull No 7. 68 p, 6x9, illus, 1906. *.075. B74

- 25 **Washing & coking tests of coal & cupola tests of coke conducted by U S Fuel-Testing plt at St Louis, Mo, 1/1/05 to 6/30/07.** RichardMoldenke, AWBelden & GRDelamater with introduction by JAHolmes. U S Geological Survey, Bull No 336. 76 p, 6x9, 1908. *6874. B336
- 26 **Engine-room chemistry: a compend for the egr & engineman; fuels & their analysis; combustion; feed water; tests of lubricating oils, etc.** AugustusHGill. 198 p, 5x7, illus, 1907. *.074. G41
- 27 **Peat: its use & infre: formation; composition; digging & drying; peat fuel; other uses of peat.** PhillipRBjorling & FrederickTGissing. 173 p, 6x8, illus, 1907. *.075. B55
- 28 **Experiments with ry cross-ties: seasoning & preservation; test tracks to determine comparative durability of green, seasoned and treated ties.** HBEastman. Forest Serv, Circ No 146. 22 p, 6x9, illus, 1908. *6882. C146
- 29 **Automatic block signals & signal circuits: Amn practice in installation & maintenance of signals el'y controlled & operated by el or other pr, with descriptions of accessories now regarded as standard.** RalphScott. 243 p, 6x9, 1908. *0712. Sco8
- 30 **Procdgs of Amn St & Interurban Ry Accountants' Assn, 1907: containing complete rept of 11th an conv held at Atlantic City, NJ, 10/15-17/07, 2 vols.** 206 p, 366 p, 6x9, illus, nd. *6900.058. As3 1907. 1-2
- 31 **Essays in mun administration: civil service reform; mun codes in the middle west; extension of mun functions; mun ownership; mun itg in Detroit; mun conditions abroad, etc.** JohnAFairlie. 373 p, 6x9, 1908. *.02. F15
- 32 **Procdgs of Providence Conference for Good City Gov't & the 13th an mtg of Nat'l Mun League, held Nov 19-22, 1907 at Prov, RI: mun govt; election methods; systems of taxation, taxation of banks, rys & pub serv corps; mun sanitation.** 417 p, 6 x 9, 1907. *6900.058. M92. 1907

Water Supply and Irrigation Papers.

- 33 **No 140. Field measurements of rate of movement of underground waters: methods; measurements in California and New York; specific capacity of wells; factors governing yield; methods of construction; tests of pumping plants.** CharlesSSlichter. 119 p, 6x9, illus, 1906
- 34 **No 181. Geology and water resources of Owens Valley, California: underground waters; reservoir sites; climate; artesian wells.** WillisTLee. 28 p, 6x9, illus, map, 1906
- 35 **No 211. Surface water supply of Colorado River drainage above Yuma, 1906.** RIMeeker, HSReed. 149 p, 6x9, illus, map, 1908
- 36 **No 212. Surface water supply of the Great Basin drainage, 1906.** ECLeRue, ThomasGrieveJr & HenryThurtell. 98 p, 6x9, illus, map, 1908
- 37 **No 217. Water resources of Beaver Valley, Utah: wells, precipitation records at twelve stations; measurements on Beaver River, Indian Creek, North & South Creeks.** WillisTLee. 57 p, 6x9, map, 1908

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STONE & WEBSTER PUBLIC SERVICE JOURNAL

AUGUST, 1908

EDITORIAL COMMENT

In the pages of this issue of the Journal appears an important article elucidating many of the problems involved in the use of coal to produce energy. It is not necessary to point out the great interest which this subject must have for all operating men in the Stone & Webster organization; the business of creating electrical energy is, of course, not a business of creation at all but a business of transforming energy and no small part of the energy transformed in a coal fed plant depends upon the coal. The coal is the beginning and source of the whole transaction and it is desirable that all the knowledge of the subject obtainable should be at the disposal of the man who would deal intelligently with the capture and transformation of energy. We are disposed to believe that this contribution will prove of great interest and perhaps of great importance to nearly every reader of this magazine. Mention of this article cannot end without acknowledgment of the courtesy of those who made its appearance possible—the courtesy of the author and the Arthur D. Little Laboratory of Boston.

* * *

On April 24 Mr. A. S. Michener, comptroller for Stone & Webster, delivered an address before the electrical engineering students of the Massachusetts Institute of Technology on "Street Railway Accounting." It was so timely, so interesting, and so

thorough an exposition of the subject, that we have been trying ever since its delivery to find space for it in the Journal, which, owing to its length, it has been somewhat difficult to do. It appears, however, in this month's issue. And in commending it to the reader, we take the opportunity to reproduce the following letter, which Prof. D. C. Jackson of the Institute wrote us at the time with reference to the circumstances which produced Mr. Michener's effort:

"In connection with lectures given by the teaching staff to senior students in the electrical engineering course of the Massachusetts Institute of Technology, which relate to the application of science and judgment to the construction and operation of electrical installations, it has seemed desirable to bring in some lectures from outside of the Institute teaching staff for the purpose of adding to the richness of the examples and illustrations. It has seemed particularly important to extend the examples relating to accounting methods in electric light, electric power, electric railway and gas companies. We wished to have the philosophy of accounting and the relations between the accounting department and the executive, engineering and operating departments expounded to the students by a man who is giving his full thought and practice to those specific matters. Mr. A. S. Michener, comptroller of the various Stone & Webster public service organizations, seemed to be a man ideally capable of preparing and delivering these lectures, and he kindly undertook to prepare one lecture on the theory of accounting for electric railway companies and the relations of the accounting department to the executive, the engineering and the operating departments of such companies. This lecture was of so much interest and value to the students who heard it, that it is my only regret that Mr. Michener's duties would not afford him time to prepare a second lecture dealing in a similar manner with electric light and power companies. The lecture was so admirable, that it is a pleasure for me to write this introduction to accompany its publication in the Public Service Journal."

The Blame for Railroad Accidents

"The Public's Responsibility for Railway Accidents" is the title of a very sound and timely article by Mr. Julius Kruttschnitt in the July Appleton's. Mr. Kruttschnitt is director of maintenance and operation of the Union Pacific system and the Southern

Pacific Company, and ought, if anybody, to be able to speak from the facts. He admits the appalling character of the accident record of the American railroads, as he needs must when he considers that during the last official year the number of the killed amounted to 10,618 and that of the injured to 97,706. Of course, all these accidents did not occur in connection with railroading in the strict sense. Of the 97,706 cases of injury, more than 34,000 occurred in handling tools, machinery supplies in shops, freight at stations, etc.; and 251 of the deaths were from similar causes. Of the casualties due to railroading proper—that is, train movement—9,051 of the deaths and 45,455 of the injuries were attributed to falling from cars, jumping on and off cars, to being struck by cars, and like causes. And a striking fact in connection with these particular figures is, that 5,381 of the killed and 5,927 of the injured were trespassers. Briefly the larger part of the accidents last year were due to no fault of the railroads.

Still, when all these cases are deducted, the situation remains bad enough. It is represented in figures by 1,316 killed and 17,962 injured. Yet the railroads have spent approximately \$125,000,000 on safety appliances. Mr. Kruttschnitt admits that “we may charge to the railroads incomplete or imperfect safety appliances.” These play a part, though, he thinks, a very slight one. There remain, therefore, these causes: Flaws in machinery and equipment, negligence on the part of officials, and negligence and disobedience of orders on the part of employees. Mr. Kruttschnitt declares that he has no desire to belittle the responsibility of the railroads, but he contends, nevertheless, that a very large part of the responsibility for railroad accidents rests, in the final analysis, with the public, and that it is to the public we must look for the real remedy. He backs up Mr. J. O. Fagan, whose views, as expressed in the “Confessions of a Railroad Signaller,” we called attention to some months ago. Mr. Fagan, himself a railroad employee, has summed up his ideas in these words, “We railroad men are to blame for preventable accidents . . . by downright neglect to do as we are told. . . . In some way we have got it into our heads that the rules are permissive, not positive. . . . As a matter of fact, we, the employees, are bigger than the rules.”

The long and short of it is, that Mr. Kruttschnitt holds that the efficiency of American railroad employees has deteriorated in the past few years. “No matter,” he declares, “how generously every material equipment is provided, how lavishly capital is ex-

pended for improvement of road-bed, additional side tracks, terminals, safety devices, and the like, the outlay is useless unless the road is efficiently manned." The trouble is that the attitude of the employees has, in his opinion, changed. "That it has been changing from loyalty and consideration to indifference if not disloyalty, no observer will deny." Why? Because, according to Mr. Kruttschnitt, of the present state of public opinion, "which condemns all corporations indiscriminately." Railroad employees, he contends, naturally reflect the state of public opinion. When it regards the rights of corporations lightly, or questions whether they have any rights, the attitude of employees will respond. Let public opinion add its weight to the rules and safety appliances provided by the railroads, and the scale will turn. "No man, and no body of men in this country is bigger than public opinion. If the rules are disregarded, if discipline is lax, and lives are lost thereby, the remedy is in an educated and aroused public opinion. At present railroads cannot enforce a thoroughgoing discipline."

Is the Supply of Electricity Permanent?

One of the columns of the Boston Transcript had a paradoxical appearance the other day. It was headed by an article entitled, "Increase in Timber Cut," showing the yield to be seven per cent. more in 1907 than in 1906. This was followed immediately by an article headed, "Anthracite Will Be Gone in 2055." The paradox consists in the fact that, though the forests are rapidly disappearing, a member of the Geological Survey is reported as prophesying that future generations "will have so far developed methods of subduing and utilizing other forces of nature that the need of coal for the production of heat, light and power will to a great extent have been eliminated."

It would, we suspect, be rather difficult, under the circumstances, to state precisely what those methods are likely to be. It is not at all probable that light, heat and power will be furnished by wood used as fuel. Indeed, nobody expects to find such a substitute in wood. What the people who talk so hopefully about new methods mean is that electricity will take the place of the power now bred by coal. As a matter of fact, most of the electrical power now used is based on coal—today, electricity is only a proximate means, the ultimate, or *sine qua non*, being that rapidly vanishing substance, coal.

How, when the coal is all gone, are we going to get our electricity? Shall we find a way to get it when and as we want it from the sky? Nobody knows what may happen, but the world is not yet basing its commercial calculations on any such prospect. It is no secret that we intend to obtain electricity by water power. But how? If we denude the mountains of their timber the water courses will have a natural tendency to dry up. This aspect of the situation has been discussed not a little in these columns in the last twelve months: the recent figures on the increasing timber cut and the decreasing coal supply, give the discussion new pertinency. We Americans have the most hopeful temperament on earth—it is, we pride ourselves, our most valuable asset. Though we are not ignorant of the rapid deforestation of the country, we hope for the best and take no counsel of our fears. We tell ourselves, no doubt, that nature will renew the forests and all will be well. Undoubtedly she will, and undoubtedly, as soon as the trees get the right growth, we shall renew the cutting.

That is a precarious policy. It is setting the wolf to guard the sheep. The interests of the owners of timber lands do not run much beyond their own day and generation. With them, as with other people, a bird in the hand is worth two in the bush. The people in their individual capacity are destroyers of the forests; if they are ever to become conservers of the woodlands, it must be in their collective capacity. And if we are going to act in our collective capacity, now is the time to begin. As it is, we are gambling with fate.

But this is not the whole of the problem. It is of no avail for the government, by its care of the forests, to preserve the water courses, if the water courses are to be kept from exploitation. Possibly it might be comforting to know that they were being kept intact, even if their use were restricted; because we should have a feeling that in the last resort—when things had reached a desperate pass—they could be utilized. But how foolish such a policy! The time to prepare for the worst is now, not when we are in the throes of distress. Such preparation is very largely precluded by a senseless fear that the owners of water rights—notably the national government—will be cheated if they allow the use of their rights to industrial promoters on the terms which the latter can today afford to meet.

In short, there is a great deal of talk about the "future value" of these rights, and the object is for Uncle Sam to obtain this

future value now and here. That never was the way future values were obtained, and probably never will be. Theoretically, food in a time of prolonged and wide-spread famine has any value you may care to set on it; but as a matter of fact, you can't make the theory work without wiping out the race. It is more than conceivable that if the owners of unexploited water rights withhold them from use until we must perish without them, there will not be sufficient energy and capital left to utilize them. It is use that makes value. If the water rights are to have a value in the future, it can only be given them by present use.

OLD AGE ANNUITIES AND EMPLOYEES

By LOUIS D. BRANDEIS.*

Public service corporations and others confronted with the necessity of providing in some way for superannuated employees will note with satisfaction the introduction in Massachusetts of the Savings Bank Insurance and Annuity System, which furnishes at least a partial solution of the problem. And that solution is the simple and rational one of enabling and inducing employees to provide themselves with old age annuities out of current wages.

Every industrial community is coming to recognize the necessity of some adequate system of old age provision for workingmen. Germany adopted compulsory old age insurance more than twenty-five years ago, dividing the burden between the State, employer and employee. England is now turning to old age pensions borne by general taxation. Massachusetts appears determined to avoid, if possible, both these alternatives by trying to help her workingmen to provide their own old age annuities. Her plan is to make old age insurance voluntary instead of compulsory; to make her "veterans of industry" independent instead of dependent; to relieve instead of further burdening general taxation.

The Massachusetts plan rests upon the principle that with wages properly high, the cost of caring for old age,—like the cost of providing by life insurance against the contingency of premature death,—should be borne by the workingman as a fixed charge of living. The plan recognizes that while the employer must do his part in paying high wages, and the employee must do his part by saving from these wages enough to meet this fixed charge; yet the State has also an important part to perform. The State must provide adequate means for securing and caring for these savings so that they will be properly collected and applied in furnishing to the workingman the needed old age and life insurance. This it is believed will be accomplished by extending the functions of the savings bank.

*Of the Suffolk Bar.

Massachusetts is trying to make saving popular by giving to the saver all that his money can earn, and by furnishing her people if possible with as many opportunities for saving money as they have for wasting it. In establishing now insurance and annuity departments in her savings banks, she is simply building further on the structure commenced nearly a century ago when she inaugurated the American savings bank system; and she builds upon a solid foundation. The savings banks are among the chief causes of Massachusetts' prosperity. With little over 3,000,000 people, 1,971,644 separate accounts averaging \$358.55, and aggregating \$706,940,596 have been developed in her 189 savings banks. Her people have been led to save by knowing that the money was not only safe, but profitably invested, and invested for their own benefit. Massachusetts savings banks are purely mutual concerns. They have no stockholders. All the profits,—all that their money can earn,—goes to the depositors; and these earnings are large. Last year the savings banks earned gross 4.73 per cent. on deposits; and their expenses, other than taxes, were less than 1-4 of one per cent. of deposits. In introducing the old age annuity and life insurance department, the State has gone even further than to provide an economical administration of the savings. In order to encourage this new form of saving it bears a part of the expense of management.

The machinery provided by the new law is such as to promote a wide extension of the new system which it seeks to introduce. The technical insurance knowledge and the facilities incident to that department of the business will be supplied to the banks by the State. The act provides for a state actuary to whom the technical expert insurance work of determining the premiums and reserves framing the forms of applications and policies, and of prescribing the methods of accounting is committed; and for a state medical director, who shall have supervision of, and act as insurance medical advisor to the local physicians of the banks. Blanks and books used in conducting the business, as well as the services of these experts are furnished by the state without charge to the banks.

The savings banks are to receive applications for annuities and insurance, as they receive deposits,—that is, without personal solicitation. The premiums are to be received at the bank or some appointed agency, and not collected at the homes of the insured; for the weekly payments practiced by the industrial insurance companies a monthly premium payment is to be substituted.

But it is expected that the following simple, convenient and inexpensive method of paying premiums will, to a large extent, be ultimately adopted: Upon the issuing of the policy an effort will be made to induce the insured, if he is not already a savings bank depositor, to become such, and to give the bank a standing order to draw on the savings deposit in favor of the annuity or insurance fund to meet the premiums as they accrue. Or employees may file a standing order with their employer to reserve from the wages the amount of the premium and pay it over to the bank. The premium payments would thus become automatic so far as concerns the insured.

The Massachusetts plan of voluntary old age annuities proceeds upon the assumption that its citizens can be educated to avail themselves of the advantages afforded by the system. These advantages have been set forth in an attractive pamphlet issued by State Actuary Hunter, under the title: "Who will pay your wages when you are old and grey?" The pamphlet begins with this statement:

There are three things that every man should do.

First—Save enough money to take care of himself in his old age.

Second—Save enough money to take care of his family in case he dies.

Third—Save enough money to take care of himself and family in case he or one of the family is sick.

By means of the savings banks you have been able to save money for object No. 3, but what about the other two?

There is only one way by which you can do both of those things at one and the same time. That is by buying an insurance and annuity policy, and the only place for wage-earners to get such a policy is in one of the savings banks of Massachusetts.

The Commonwealth of Massachusetts authorizes the savings banks of this State to issue policies of insurance and annuities, in order to give the wage-earner an opportunity to get an old age annuity and insurance at the cheapest possible price consistent with safety.

The Commonwealth has gone farther than this. It has agreed to help the wage-earner to help himself by paying part of the expenses of the savings banks in issuing annuities and life insurance policies.

The Bank on your attaining the age of 65 years, will pay you \$100 every year during your life, or, in case of your death before that time, the Bank will pay \$500 to your family at your death.

Furthermore, your policy will receive its share of the profits earned by the insurance department of the Bank.

Here is a policy just suited to your needs. It will help to take care of you after your working days are done as no other means can.

Regularly once a year after you are 65 years of age, the Bank will deposit \$100 to your account in the savings department, where it will earn interest, and from which you can draw each week enough money to pay for your needs.

Besides doing all that, it protects your family in case of your death until you are 65 years of age, when the annuity begins.

A Young Man can buy this policy for less money than he can buy a life policy in an insurance company that employs house-to-house collectors.

The rates offered to the wage earners are such as should carry conviction to his mind of the value of the system; for instance:—

“Suppose you are 25 years old and pay to the Savings Bank \$1.30 each month and your neighbor who is the same age pays \$1.35 each month to the insurance company.

“When you reach age 65, you will have no more deposits to make. Instead of making deposits you will begin to receive an annuity of \$100.

“While you are enjoying the fruits of your saving, your neighbor will still be paying \$1.35 every month to the insurance company and he will have to continue paying this amount until he is seventy-five years old.

“Which would you rather be—your neighbor or yourself?”

The first savings bank insurance and annuity policy was issued on June 22, 1908, by the bank in Whitman. The People's Savings Bank of Brockton, of which ex-Governor Douglas is president, has also voted to establish an insurance and annuity department, and a rapid extension of the system is expected; since the act provides in the amplest manner for establishing agencies through which applications for insurance and annuities may be made and premiums paid. Thus any savings bank may, without

establishing an insurance and annuity department of its own, serve its community by becoming an agent of some bank which has established such a department; and a bank acting as agent merely is relieved of the necessity of providing the guaranty funds and of considerable special insurance work required of the principal bank. The provision for appointing other private agencies will probably be even more effective in securing a rapid extension of the system. Any savings and insurance bank may establish private agencies without number anywhere within the State; for instance, with manufacturing, mercantile, trade or other organizations. Thus large manufacturers, like the Regal Shoe Company, Commonwealth Shoe & Leather Company, and W. H. McElwain Company; Boston department stores, like Henry Siegel Company and Filene's, and other progressive business concerns like the Boston Bookbinding Company and the Laboratory-Kitchen, showed their recognition of the opportunities now afforded by making prompt application to the Whitman Savings Bank for agencies.

General success of the Massachusetts plan can, of course, come only with a general appreciation by employer, employee and the community of the need of some adequate system of old age annuities and life insurance for wage earners, and of the great advantages offered by the savings bank system. But the process of necessary education should not be difficult. In this movement there can be no diversity of interests between employer, employee and the public. All are obviously working for the same end. In the long campaign required to secure the necessary legislation, leaders of organized labor joined with manufacturers, merchants, financiers and philanthropists in urging the Legislature to pass the Savings Bank Insurance and Annuity Law. The League formed to promote the movement has a large membership, and the Massachusetts public service corporations are represented among its officers and members by Robert Winsor of the Boston Elevated Railway Company, Charles A. Stone, Russell Robb and Henry B. Sawyer of the Stone & Webster properties; Charles L. Edgar, president of Edison Electric Illuminating Company; James L. Richards, president of the Massachusetts Gas Companies and Boston Suburban Street Railway Company; P. F. Sullivan, president of the Boston & Northern Street Railway, and many others.

\$111,000,000,000 OF NEGOTIABLE SECURITIES

By FREDERIC J. WHITING.

Mr. Neymarck, the French economist, has produced some detailed estimates of the world's negotiable securities. When he comes to aggregates, he presents a situation which the human mind is not large enough to visualize. We are told, for example, that the negotiable securities of the civilized world amount to \$111,077,000,000. About all that one hundred and eleven billion dollars means to us is unthinkable immensity. We have something of the feeling that comes over us when told that the sun is ninety-six million miles from the earth. To most of us, however, such knowledge seems merely academic. It is no doubt interesting, if your tastes lie that way, to be told of the vast spaces of the material universe, or of the incalculable periods of geologic time,—but of what earthly use are such facts, except to the astronomer or the geologist? That is about the same view the ordinary man takes of such information as M. Neymarck has compiled for us.

Yet all such facts are intimately related to the daily life of every man, woman and child. Our material well-being, our very life on this planet, is dependent upon the facts which the astronomers and geologists have brought to our notice. Were the facts other than they are, we might not, and in all probability we should not, be here. Equally true is it that our manners of life would be vastly different were the facts relating to negotiable securities other than stated by M. Neymarck. Indeed, it must be borne in mind that while we can have no influence on geologic and astronomic facts, we can influence economic facts to our great loss. M. Neymarck's figures are, in reality, the measure of the commercial prosperity of the world. In their way, they are as impressive as the figures of the astronomer and the geologist. They define for the practical every day man his position; they show him where he stands with reference to the material prosperity at which he aims, and they are a guide to him in the matter of conserving or impairing that prosperity.

It will be interesting to note, if possible, something of the real

meaning of M. Neymarck's figures. These figures are tabulated in millions, together with those indicating population and value per head, as follows:

Countries.	Total values.	Population.	Value per head.
Great Britain	\$26,400	42.8	\$617
France	19,500	38.9	501
Germany	10,000	56.4	177
Russia	5,400	129.0	42
Austria-Hungary	4,400	45.4	97
Netherlands	2,200	5.4	405
Italy	2,300	33.2	69
Belgium	1,400	6.9	200
Spain	1,300	18.6	69
Switzerland	1,100	3.3	331
Denmark	600	2.6	226
Sweden and other European...	400	51.5	7¾
United States	34,514	83.2	414
Japan	1,563	47.9	29
Grand total.....	\$111,077	565.1	196

The first thing to be noted is that these figures represent market values. That is, they are not indicative of paper values, but of the actual cash which the people of the world have ventured to put up against negotiable securities,—one hundred and eleven billions of hard earned money has been devoted to this purpose. Stated otherwise, one hundred and eleven billions of the wealth of mankind are at stake. It should be obvious that this is a matter of transcendent importance to mankind. Looking at the material well-being of the race, nothing can be of more importance. All who have an interest in the one hundred and eleven billions might naturally be expected to pray that nothing might impair the safety of this fund. And yet, paradoxically, hundreds and thousands of persons who possess such an interest are both praying and working for measures whose sure result must be just such impairment.

Let us make our meaning quite clear. Negotiable securities are merely representative of the capital employed in carrying on the business of the world. When such securities can be negotiated easily—that is, when they pass readily from hand to hand—industrial activity tends to a maximum; in just the proportion

that the difficulty of negotiating them increases, industrial activity tends to a minimum. That is an immutable law of nature, as hard and fast as the law of gravitation. We may resent the fact and declare that we are capable of overcoming it, but it remains a fact for all that. This is a world of automatic adjustment, and no one of the forces of nature work more automatically than does man in his industrial relations with man. Hence the necessity that is always upon us to keep the capital employed in industry from impairment. When a shrinkage occurs somebody is inevitably hurt. If the shrinkage is only slight, a few persons will possibly have their incomes and wages reduced a little. If greater than that, a whole factory may have to shut down. When, as frequently happens, the shrinkage is on a very great scale, a whole continent will be plunged into "hard times." Speaking only in the most general way, that is why anything that disturbs the stability of negotiable securities is intimately related to the daily life of every man, woman and child. There is always a danger of the bread and butter being taken out of the mouths of the humblest among us.

Let us look at the situation at little closer range. We note that the one hundred and eleven billions represented by the negotiable securities of the world average about \$196 for every man, woman and child of the population. What is the fundamental meaning of that fact? Why simply this,—that every man, woman and child employed in industry has a working capital provided for him or her of some hundreds of dollars in amount. A man must be fed before he works; he must have advanced to him, in some way, at least a considerable part of the value of what he is going to produce. What is the first thing an able-bodied person needs in order to work? Why, capital. A man cannot even go fishing without it; if he borrows or steals his tackle, he merely uses somebody else's capital—if the somebody else is without capital, the borrower or thief foregoes his sport. Capital one must have in order to work. If he has some of his own, he uses it and is his own employer, and possibly an employer of other labor. Or he lends it to others who use it for him. If he is a forehanded railroad or mill operative, he has money in the savings bank, and the bank acts as his agent in lending it. If he has none of his own, he must borrow.

Now there are various ways of borrowing. One can do it on a large scale, and have practically complete control of the capital

during the period of the loan. That is the way merchants and manufacturers and corporations in general borrow. They get and keep control of the capital because the lenders are confident they will pay back with interest. But the operatives in mills and on railroads have also to borrow. Their borrowing is less obvious than that of their employers, but not less real. They do not go out into the money market and exclaim, "Lend us capital that we may work!" But their employers do it for them. It costs so much per spindle, for example, to build a cotton mill; and it costs so much to run a loom to the extent of weaving a cut of cloth. If capital cannot be borrowed the mill will not be built, and the loom will not be run, and the weaver will be out of a job. The weaver, in short, is dependent for his very industrial existence on borrowed capital—that is, on negotiable securities. As a matter of fact, all wages when they are paid are in the nature of borrowed capital.

To sum it all up, the one hundred and eleven billion dollars of negotiable securities which M. Neymarck has got trace of are the whole people's capital; for while the wage earner may not own any of the securities, or directly receive any interest or dividends on them, the securities just as certainly earn his wages as they do their owner's dividends. There is no fundamental distinction between the capitalist and the laborer. No man can directly apply capital to an industrial end without a constant expenditure of labor. And no laborer can use his labor industrially without capital. The capitalist, therefore, has no more at stake than the laborer in keeping the capital—that is, the negotiable securities—of the world unimpaired. Indeed, he has not so much; for he is considerably farther away from the starvation point.

M. Neymarck's one hundred and eleven billions of negotiable securities represent just so much credit. Money, we are told, makes the mare go. What really makes the mare go is credit. Credit is the greatest thing in the world of industrial affairs. It is today the author of practically the whole of the well being of rich and poor alike. But credit is not only the greatest thing in the world,—it is also the most delicate. It has to be treated with the most perfect consideration; if it is not, the consequences are apt to be frightful. Its penalties are proportionate to its rewards. Mere rumor will wound it, and convert what was giant strength into infant weakness.

The last thing with which the ordinary man is disposed to quarrel is his bread and butter. Most of us are strict utilitarians

on that point; we have to be, whether we will or no. We may have ideal conceptions of the social and industrial relations of mankind, but our first and most absorbing occupation is to keep soul and body together. We are prepared to submit to a good many things we do not approve, rather than find ourselves without food and shelter. In fact, most of our lives are spent in waiving our idealistic views of things. We find this a world of stern realities, and most of us have discovered that we have got to take it very much as we find it. Progress always has been slow work. Its pace may have quickened somewhat as the centuries have elapsed, but the movement is still a leisurely one. Make or break is not a very good maxim in industry. As a matter of fact, it is never employed by persons who have any real understanding of the principles of industry. Credit is like time and tide, which wait not at all upon the vagaries of the human mind. Its cardinal feature is its tendency to shrink when roughly handled. And the effect of the handling is not modified in the least by the motive which prompts the handling. An industrial institution may be adversely criticised by persons whose only aim is to correct its abuses; but the friendliness of the critics will prove no bar to the disturbing consequences of their words and acts.

It is by no means intended that adverse criticism should never be employed. There are times when temporary discomfort is a small price to pay for the rectification of vicious industrial policies. It may be suspected, however, that such times are rare. At any rate, if adverse criticism is to be employed, it should be employed with eyes open to its consequences. Most often it is employed without any real regard for consequences. Mankind seems fated, in the correction of industrial error, to proceed along the line of greatest resistance. It almost always fails to count the cost. Time and again it has attempted to destroy the foe by pulling down the pillars over its own head. The old Roman adage, "Make haste slowly," was the product of a wise experience.

The extraordinary volume of negotiable securities now outstanding in the civilized world has been produced in pursuance of aims many of which have in the last year or two been vigorously denounced by a large portion of the people. It was not in the least intended that this denunciation, and the acts prompted by it, should disturb the mercantile credit of the world, yet it has inevitably had that effect. It is certainly not our purpose to assert that the industrial depression through which America, Europe and

Asia have been passing in the last twelve months is, in the main, the consequence of the attack on corporations. The principal cause, no doubt, was the actual shortage of capital. Still, it is hardly open to question that these attacks have contributed their part to the unsettlement of industry—they have at least intensified a situation which was of itself sufficiently intense.

What everybody most actually desires at present is a recovery from hard times. The depression has gone as far and lasted as long as the most eager reformer could deem wise. M. Neymarck has figured the volume of mercantile credits throughout the world at upwards of one hundred and eleven billions of dollars. To insure the stability of that vast sum must certainly strike the intelligent mind as the first and most important task to which everyone identified with industry, employer and employee alike, should set his hand. It is not now a time for destructive criticism. What every one would like to see is mills and railroads and every other kind of industry running at something like normal capacity. There is enough idle capital to produce this result, but not quite enough confidence. By confidence we mean credit; and by credit we mean the mobility of negotiable securities.

STREET RAILWAY ACCOUNTING

By A. S. MICHENNER.*

A transportation company may be viewed with regard either to its system or its service. From the public or outside standpoint attention is drawn more to matters in connection with the service, but to the men within the organization the matter of first importance is the system. The greater the degree of perfection in the system, the more satisfactory will be the service to the public.

The system, as an entirety, is the "machine which performs the service," and its problems are those relating to engineering in connection with construction, maintenance or the upkeep of the property, operation of the system, and the business principles prevailing in its management.

This paper treats of but one branch of a street railway system, viz., the Accounting Department, but at the outset all the general departments will be referred to, in order to give a brief outline of the entire organization.

In the larger street railway systems, there are usually the following general departments:

Engineering, which deals with those problems relating to the design, method and actual construction of buildings, track and roadway, the power system, and the design and type of equipment to be used, etc.

Purchasing, which has to do with the ordering of all material, supplies, and equipment purchased.

Maintenance, which has to do with repairs and renewals of way and structures and of equipment.

Power Production, which has to do with the production of the motive power.

Transportation, which has to do with the moving of cars and the carrying of persons and goods.

*Comptroller, Stone & Webster. This paper was read before the electrical engineering students of the Massachusetts Institute of Technology on April 24, 1908.

Legal, which looks after the legal interests of the corporation,
and

Financial, under which comes the Accounting Department.

The financial success of a street railway company is entirely dependent upon the intelligent conduct of each department, and upon the absolute harmony and co-operation existing between them. The familiar statement that "no chain is stronger than its weakest link" exactly defines the correlation of these departments in respect to the spirit of intelligence, economy and co-operation with which all must be conducted. Should the work of the Engineering Department be generally faulty in design or weak in construction, should extravagance prevail in the purchase of material and equipment, should the property be allowed to run down through lack of proper maintenance, should the power production be inadequate, should bad discipline or gross negligence in the Transportation Department result in poor service to the public, should the settlement or defense of damage claims rest with an incompetent Claim Department, or should the accounting system record inaccurate or incomplete results of operation—in any one of these contingencies the company would labor under a severe handicap.

In regard to the employee, the tendency to specialization is just the same in the transportation business as in any other commercial field, but the employee goes farthest and reaches that par excellent degree of fitness who avoids a too narrow rut of specialization, and who acquires a knowledge of the workings of departments other than the one in which he is engaged.

It cannot be truly said that any one of the general departments is more essential than another—each is equally concerned, directly or indirectly, in maintaining or increasing the net earnings of the business. That being the case, it is to the mutual advantage of the company and the employee for the latter, in whatever department he may be employed, to have at least a general knowledge of the methods by which the receipts and disbursements of the business are classified and recorded. With that knowledge, he has a better understanding of the need for efficiency and economy, and can also differentiate the better between false economy and true economy.

While an engineer need not be an accountant nor understand all the theories of accounting, he must know enough of its principles to get a grip upon the commercial end of the business—if that is the goal he is striving for. He needs something more than an engineer's knowledge of the proper location and construction of

buildings, track and other structures, and should comprehend the relationship of the expenditures therein to the financial success of the company.

The corporation, itself, traces its success largely to an accounting system which has combined thoroughness with simplicity. The main object of a classification of accounts in any business is to disclose the true cost of operation, and to furnish the management with such information as will enable it by way of analysis and comparison to manage the property with intelligence and economy.

In the case of transportation companies, a uniform and standard classification of accounts became a positive necessity, not alone for their common good but because of the great concern of the public in this class of public service corporations. It is because of this public concern that the Federal Government, through the Census Bureau and the Interstate Commerce Commission, and the States, through their railway commissions, have in recent years called for so much data concerning transportation statistics. Because of the magnitude of these enterprises, especially as affecting the rights of the public, managements have come to recognize from a double sense of prudence and duty, a responsibility to the public as well as to stockholders that calls for careful accounting and fair business treatment. These considerations all tend to make transportation accounting a highly scientific department of the system.

The chief accounting officer of a street railway company is known under different titles. In the case of companies under the management of Stone & Webster, the chief local accounting officer is the Assistant Treasurer, who is responsible for the conduct of the company's accounts and who has a force of bookkeepers and clerks varying in number according to the size of the company. It is his duty to safeguard and account for all of the revenue, and to present various statements concerning receipts and expenditures, and concerning the condition of the accounts. His records are given periodical examinations by travelling auditors, who report the exact condition in which they are found.

Accounting, is the art of recording in a systematic manner business transactions affecting assets and liabilities. These transactions are recorded in various books of account, and, from the records thus made, the numerous statements are drawn analyzing earnings and expenses, and showing their effect upon the assets and

liabilities of the company. Such statements are an absolute necessity to officials and directors, and govern their actions. They present a picture, expressed in figures, of the condition of the business, the receipts from the several classes of service, the expenditures in the operation and improvement of the property, and comparisons of the same, month by month and year by year.

Assets, are property, possessions, or resources.

Liabilities, are debts and obligations due others.

The assets of a street railway corporation are usually grouped as follows:

Plant, covering those assets which are fixed, which are permanent and essential in the business and not easily convertible into cash, such as real estate, buildings, track and roadway, equipment and other tangible and intangible fixed assets.

Securities of Other Companies, representing investments in other companies' securities.

Current Assets, such as supplies, merchandise, and those assets which are active and vary from day to day. Including also

Bills Receivable, consisting of notes and accounts due from others, and

Cash.

The liabilities are usually grouped as follows:

Stock, being the total par value of certificates of stock issued to shareholders, representing their rights in the management, profits and ultimate assets of the corporation.

Bonds, representing the obligations under seal secured by mortgage upon the corporate property or its earnings.

Bills Payable, representing obligations of the company on notes and accounts for money loaned, goods purchased, or services rendered to it.

Surplus, the account into which is carried the yearly balance of profit and loss. It represents the excess of assets over liabilities.

Where the operations are productive of net losses instead of net profits, in place of a surplus, there is a deficit, which represents the excess of liabilities over assets.

The books of account, into which are entered the record of

transactions, are called Original Entry Books and Ledgers. The two principal Original Entry Books are the

Cash Book, recording all receipts and payments of money, and the

Journal or Register, recording all charges and credits not cash.

Ledgers are books of final record. The main Ledger, usually called the General Ledger, contains a summary of all the transactions of the company. It is a transcript of items first entered into the Original Entry Books.

To avoid being tedious, the various records of account will not be described.

Entries into the Cash Book and Journal Register are made from and supported by reports and classifications of labor, material and supplies used, and invoices from creditors. These reports, classifications and invoices are thoroughly checked and properly approved before entries from them can be made into the books of account. Extravagance can be detected, and errors prevented, only by means of a most thorough method of checking and a system requiring such approvals as will fix responsibility for authorizing or approving items which are unnecessary and charges which are erroneous.

The usual sources of income to a street railway company are from

Cash fares,
Ticket sales,
Chartered cars,
Mail,
Freight and express,
Advertising in cars, and
Rentals.

The same degree of care must be exercised to see that the company receives all the income to which it is entitled, and that cash received is properly accounted for and guarded. As the principal source of income is passenger receipts, the utmost pains are taken to see that fares are collected, that they are registered, and that they are all turned in.

The average person is apt to think that the company's accounting is confined to the bookkeeping departments, and fails to appreciate the extent to which it permeates and forms a part of the

work in every branch of the system. The act of the conductor in registering fares and reporting the same is just as much accounting as the act of the clerk who checks them; so is the act of the foreman in reporting the time of his men, or in making out requisitions for material, the act of the storekeeper in reporting deliveries of stores, and the act of any employee reporting receipts and expenditures in connection with his work.

The standard Classification of Construction and Expense Accounts was established by the accountants' branch of the American Street & Interurban Railway Association some ten years ago, and is used by a majority of street railway companies in this country.* The Classification describes each account and states in detail what items should be charged to it.

The Plant Accounts are those making up the group of property accounts under that head, and, as stated before, are the permanent or fixed assets of the company. They constitute the tangible or substantial, and the intangible property of the bondholders and stockholders who have invested their money in the enterprise.

The principal plant accounts are as follows:—

Organization, against which is charged all expenses incurred in effecting organization.

Engineering and Superintendence, against which is charged all expenditures for services of engineers, draftsmen and superintendents employed on preliminary and construction work, and all expenses incident thereto.

Right of Way, all expenditures in connection with securing or paying for rights of way, including cost of real estate for same.

Track and Roadway Construction.

It is not my intention to tire you by defining all of these accounts to the extent described in the Classification, but in order that you may appreciate the thorough manner in which it is done I will give you, as an illustration, the complete description under the head of

Electric Line Construction, against which is charged all expenditures for overhead, underground, third rail, or surface contact electric line construction, including labor, material, tools, freight, hauling, distribution

*A new and more exhaustive classification is being prepared by the Interstate Commerce Commission and a committee representing the American Street & Interurban Railway Association.

of material, and all other expenses incident to the work; cost of punching and drilling rails for track wiring, rail bonds, poles, labor and material for setting and painting poles; feed wire, guard wire, span wire, strain wire, supplementary wire, trolley wire, ground feeders, underground feeders, pole fixtures, hangers or suspensions, insulators (overhead), lightning arresters and appliances, signals and signaling apparatus, overhead crossings and switches, ground terminals, and all labor in connection with putting same in position; conduits and conduit appliances for underground trolley construction, including conductors, insulators, sewer connections, sewer traps and underground feeders; third rails and insulators for third rail construction; surface contact appliances for surface contact roads, including magnets, contact boxes, manhole frames and covers.

Then follow

Real Estate used in operation of road.

Buildings and Fixtures used in operation of road.

Investment Real Estate.

Power Plant Equipment.

Shop Tools and Machinery.

Cars.

Electric Equipment of Cars.

Miscellaneous Equipment, such as water cars, sprinkling cars, sand cars, salt cars, supply cars, and other work cars, snow plows, sweepers, scrapers, horses, harnesses, and the like.

Interest and Discount, which is charged and credited with all interest paid or received in connection with funds for construction, and all discounts or premiums resulting from the negotiation of the company's securities.

Miscellaneous, all expenditures for printing and stationery, office supplies and expenses, damage claims, wages of clerks, and all other expenses incident to construction and not otherwise provided for.

In a Stone & Webster company the authority for doing new construction work or purchasing new equipment is a properly approved improvement requisition which a local manager must first

fill out, recommending the work or the purchase, with full description, stating why it is necessary, and, in the case of new construction, showing the following estimates:—

Cost of the work,
Increase in gross receipts resulting from the work,
Increase or decrease in expenses resulting from the work,
Increase in net receipts resulting from the work,
Length of time required to complete the work,
The amount of material on hand that can be used, and
Proposed distribution of cost.

The improvement requisition, if approved by the proper executive officers, is also authority for the charge against the particular Plant Account.

Next, in regard to the classification of expense accounts.

The first impression one gets of a street railway system is its physical appearance. Substantial construction, first-class equipment and an economically arranged system are indicative of a prosperous business, while bad construction, old equipment and a poorly arranged system naturally justify the opposite conclusion. But experience teaches that appearances, however favorable, do not always tell the story. The physical property of the company may appear, as the slang phrase goes, "all to the good," and its cars may be well filled with passengers, but after all its financial success is measured in *dollars of net earnings*, those net earnings being largely dependent upon the skill with which the operating expenses are kept within reasonable bounds. Outside of those agents or employees whose duty it is to collect the revenue or increase the business of the company, the common aim throughout the organization is improved methods of economy and lower cost of operation. Therefore is the necessity for a scientific classification of expense accounts.

The classification of operating expenses is divided into the following three general heads:—

Maintenance,
Transportation,
General Expenses.

By maintenance is meant the cost of repairing, renewing and replacing those parts of the plant which become worn out, destroyed or abandoned.

There are two subdivisions of Maintenance:—

1st. Maintenance of Way, showing in three separate accounts the cost of repairing, renewing or replacing Track and Roadway, Electric Line, and Buildings and Fixtures; and

2nd. Maintenance of Equipment, showing in six separate accounts the cost of repairing, renewing and replacing Steam Plant, Electric Plant, Cars, Electrical Equipment of Cars, Miscellaneous Equipment, and Shop Tools and Appliances.

Transportation Expenses are those covering the cost of producing power and operating cars. There are also two subdivisions under this head:—

1st. Operation of Power Plant, showing in six separate accounts the cost of power, viz., Plant Wages, Fuel for Power, Water for Power, Lubricants and Waste for Power, Miscellaneous Supplies and Expenses of Power Plant and Hired Power.

2nd. Operation of Cars, showing in nine separate accounts the cost of

Superintendence of Transportation,
Wages of Conductors,
Wages of Motormen,
Wages of other Car Service Employees,
Wages of Car House Employees,
Car Service Supplies,
Miscellaneous Car Service Expenses,
Cleaning and Sanding Track,
Removal of Snow and Ice.

General Expenses are those covering cost of administration, and expenses other than those of maintenance, producing power and moving cars. In fourteen separate accounts are shown the cost of

Salaries of General Officers,
Salaries of Clerks,
Printing and Stationery,
Miscellaneous Office Expenses,
Storeroom Expenses,
Stable Expenses,
Advertising and Attractions,

Miscellaneous General Expenses,
Damages,
Legal Expenses in connection with Damages,
Other Legal Expenses,
Rent of Land and Buildings,
Rent of Track and Terminals,
Insurance.

There are in all 38 primary expense accounts, so arranged as to record the cost of every significant detail of operation. It is the simplest matter, from these records, to analyze the effect of each class of expense upon the net earnings, and its relation to the gross earnings. For example, you can determine what per cent. of every five cent fare collected was spent for maintenance of way and structures, what per cent. for maintenance of equipment, what per cent. for the production of power, what per cent. for operation of cars, and what per cent. for general expenses. You can go into greater detail and find out what per cent. of the fare was spent for each of the 38 items of expense. If the management finds that the percentage spent for fuel, for wages of trainmen, for salaries of general officers and clerks, for damages, or for any other item was excessive, it immediately begins seeking ways and means for reducing such cost.

One of the difficulties encountered in accounting is a proper differentiation between construction expenditures, which go into the Plant Accounts and do not as such affect the net earnings, and maintenance expenditures, which are a part of the cost of operation and therefore do affect the net earnings. It is manifestly wrong to charge against Maintenance (which is expense) the cost of improvements to the property, and it is likewise wrong to charge repairs, renewals or replacements into Plant, except that in the case of replacements, Plant may be charged with the excess cost of the new unit over the cost of that which is replaced.

Maintenance takes care of ordinary wear and tear of the property and keeps it in operative condition. But there is another kind of wear and tear or change taking place in Plant, which may be termed "Depreciation"—or, as it is sometimes called, "Deferred Maintenance." The change may be so gradual as to be for a time imperceptible, but it is surely happening, and it is the policy of wisdom and foresight to recognize it. A discussion on street railway accounting would be incomplete without referring to this question of depreciation—one of the most serious problems con-

fronting the management of a property. In the case of large permanent undertakings where the multiplicity of plant units is so great that renewals and replacements approach in time an average that will make expenditures therefor nearly uniform, the matter of depreciation may not be of such grave consequence. But where there is no such average to insure continuous preservation of the property, it becomes the duty of a management to make proper provision for depreciation before figuring net profits, because in such cases there can be no true net profits until loss by deterioration is accounted for.

The term "Depreciation" is used to represent either the change which is taking place or the method of counteracting it. In the latter sense, it is the means of distributing over current years a proportionate part of the total cost of Plant structures, which will become valueless or incompetent to perform their functions through a gradual wasting away, or which will no longer produce satisfactory results owing to a great growth in the business or to changes in the arts. There are various ways of doing this. If practicable, the most accurate method would be an analysis of the Plant to ascertain the original cost of the different units or classes of units, date of purchase or installation, estimated residual value, the probable term of life, and the amounts which put aside at simple interest or at compound interest, or without interest, would in the estimated periods of life equal the original cost.

Among the other accounts which have not been mentioned are Suspense and Accrual (or Apportionment), which may be either asset or liability accounts.

It often happens that there are charges or credits which at the time cannot be entered direct to any other account; they are, therefore, entered temporarily into an account called Suspense, to be transferred later to appropriate accounts.

Accrual, or Apportionment, Accounts are used for accruing certain items not due, or for distributing certain charges or credits over a period of months within a year, rather than during the current month when payment was made or received. Such accrual or distribution prevents violent fluctuations in earnings and expenses that would destroy the value of very necessary comparisons. Among the items distributed or accrued are unexpired insurance, taxes, interest on notes, interest on bonds, and sinking funds. These items should be no more of a burden or a benefit to the month in

which they happen to be paid or received than to the other months during the period which the charge or credit covers.

At the end of each month, after all of the receipts and expenditures for the month have been entered into the books of account, the statements covering the operation are prepared. The two principal statements are the Balance Sheet and the statement of Earnings and Expenses.

The Balance Sheet is a summarized abstract of the General Ledger. It gives the exact condition of the assets and liabilities of the business, and discloses whether the property has been operated at a profit or at a loss.

The statement of Earnings and Expenses is summarized to show

The total Gross Earnings,

The total Operating Expenses,

The net Earnings, which are the excess of earnings over operating expenses.

From the Net Earnings are deducted

Fixed Charges, or those that are fixed and regular in their recurrence, such as interest on bonds and interest on notes payable, and, by the greater practice, taxes, although some companies treat taxes as an operating expense.

There are further deductions from net earnings by some companies, in the way of reserves for specific purposes, the most familiar being a

Sinking Fund, a fund set aside, so much each month, to meet some future engagement, such as the retirement of bonds.

With these deductions from Net Earnings, the amount remaining represents the Net Profit.

This statement usually shows the figures for the current month and the accumulated totals for twelve months ending with the current month, compared with the figures for the same month and twelve months' period of the previous year. It thus gives a comparison enabling the officials to follow the trend of operation and note the rate of increase or decrease in the earnings, the expenses, and the fixed charges.

In an examination of a statement of earnings and expenses of a street railway company, one of the first things sought is the per cent. of operating expenses to gross earnings. To the executive

officer or director, this information is of considerable importance, and is a fairly reliable indicator of economical or extravagant management, or of usual or unusual conditions. If the percentage is high, he is in a position to know whether the fault lies in bad management, or whether the cause is traceable to some such extraordinary condition as heavy maintenance or damage expense, to a strike, boycott or depression in business. To the outsider, however, or to one not in possession of all the facts in regard to the management and conditions affecting the operation of a company, this percentage is oftentimes of very little value, and in many cases entirely misleading. A low percentage is of no significance unless one knows that the property is being well maintained, and that renewals and replacements are being charged to Expense. The criticism of one company having a higher percentage than another company may be unjust, because the difference upon investigation might be found to result from the fact that the former company was caring for its property and charging its full maintenance against Expense, while the latter was either neglecting its property or charging a part of its maintenance into Plant or against a reserve created out of Surplus.

In making a comparison of companies, the question of location must be borne in mind. One company may be located nearer to its source of fuel supplies, or may be utilizing water power, or may have easier grades; in either case, its cost of power will be lower than that of a company less fortunate in location. One may be located where labor is plentiful and cheap, and the other where labor is scarce, compelling it to pay not only higher wages but to employ less competent help—whose carelessness results in higher damage expense. And again, one company located in a warm climate has less snow expense, or none at all, and may use the same type of car the year round, while the other is located in a cold climate, has a heavy snow expense, and having to carry snow equipment, and different types of cars for different seasons of the year, has a greater maintenance expense and a greater investment, calling for heavier interest charges.

There is one department in the larger street railway systems that has not yet been mentioned, and that is the Department of Statistics. The nature of the data compiled in this department is so closely analogous to accounting data as to be almost a part of the accounting system.

A banker or an investor will examine a company's balance

sheet, analyze its statement of earnings and expenses, and its fixed charges, and base his judgment of the merits of its securities by determining certain percentages and ratios, such as the percentage of operating expenses to gross earnings, the ratio of capitalization to gross earnings, the ratio of net earnings to fixed charges, the factor of safety on bond interest, the per cent. earned on the stock, and so on. As a rule, he does not concern himself about statistical data covering the operation of the property, partly because a considerable portion of such data is rarely published, and partly because he has not been educated to a realization of its value.

The operating man, on the other hand, seldom interests himself with percentages of earning power in connection with securities. He is vitally concerned with statistics covering car performance, production and consumption of power, density of traffic and the like. His unit of measure is the car mile, or the car hour, or the car day, and he wants such information as the total number of miles and the total number of hours the cars have run, the number of passengers carried, the earnings and expenses per car mile and per car hour, the percentage of transfer tickets to passengers carried, the earnings and expenses per passenger, the cost of maintenance of track and roadway per mile of track, cost of power per car mile, the number of kilowatt hours generated and purchased, cost per kilowatt hour, number of kilowatt hours used per car mile, and much other data which he needs in his efforts to reduce the cost of operation and increase the efficiency of the system.

Professor Jackson asked me to talk to you concerning the philosophy of street railway accounting, and in my attempt to do so I have merely outlined the accounting system. It would seem to be unnecessary to go into greater detail, because, as engineers, you will not be expected or called upon to become expert in the matter of accounts. If that were so, you would all be accountants and few of you engineers.

My endeavor has been to give you but a general idea of that branch of knowledge which is essential in any commercial enterprise, and to impress upon you its very great importance. From the standpoint of business success, it is just as necessary whether your field of employment be in transportation, mining, manufacturing or trading, and your progress will be the easier if you have that knowledge.

Men are prone to be narrow and selfish in their individual

fields of employment, and occasionally we run across that most difficult and least useful of all employees—the man who thinks that his own line of work is the “whole thing,” that other departments are of minor consequence, are altogether theoretical or impracticable, and that the bane of his service is the interference and red tape of system. He will say “I’m here to do this particular thing. It’s up to me to get it done, and I haven’t any time to bother with records or to learn accounting.” To a certain extent he is right—he does have his particular task, and should not be handicapped with red tape nor *burdened* with writing reports. The trouble is, however, that what he considers a hardship is usually no hardship at all. He simply does not or will not see that but a little care on his part and a very little of his time are necessary to report the result of his work; and that it is just as important to learn the cost of production or operation as it is to do the work itself.

A firm or a corporation has a right to expect two things from every employee—intelligence and co-operation; without that combination, he is a dead weight. It is team work that tells in business just as it is in sport, and individual skill counts for naught unless there is entire harmony and combined effort. To promote this spirit and to build up a broad gauge and harmonious personnel in the technical and operating departments, some of the larger transportation companies are developing a system of training the young men who are candidates for positions in those departments. These young men are called “students,” and are passed through different departments in order to give them a broader understanding of the business.

At the last annual convention of the American Street & Inter-urban Railway Association, a paper was read suggesting that the following students’ course consisting of one and one-half years be provided for technical graduates entering the service of a street railway company:—

Three months under the Master Mechanic to serve in the car houses and repair shops as helper, on car inspections and repairs, construction of special parts, tests, etc.

One month under the Purchasing Agent, part of the time with the storekeeper.

Three months in the Motive Power Department, as helper, oiler, assisting in tests, designs for repairs and inspections, etc.

Two months in the Transportation Department to do

miscellaneous work in connection with the preparation of time tables, and to become familiar with the train dispatching systems, etc.

Two months on outside line work, as assistant with the regular repair gang, etc.

Three months in the Way Department, to assist in laying out details of new construction, and to assist in surveying and other field work.

Two months in the Accounting Department to become familiar with the methods of accounting used and the relation of this department to the others; and finally

Two months in the General Manager's office.

This matter was pretty thoroughly discussed, and naturally many objections were raised both as to the method suggested and the time allotted to some of the different departments. I refer to the paper and to the discussion simply to illustrate the tendency to the broad training of employees who are to be assigned to the technical and operating departments of the transportation business.

SOME THINGS A MANUFACTURER SHOULD KNOW ABOUT COAL

E. G. BAILEY*

The majority of manufacturers are dependent upon the combustion of coal for the operation of their mill. The man who is responsible for the continuous and economic operation of the plant should know: (a) Where he can always get coal when he needs it. (b) Where he can get coal of such character and quality that his plant will not be crippled for lack of steam. (c) What coal is the most economical for him to burn. (d) How to convert a large percentage of the heat energy of the coal into useful work.

(a) It is an exceptional circumstance when a manufacturer does not have many kinds of coal offered him at competitive prices. But at times of strikes or delays in transportation he is sometimes compelled to seek coal and pay whatever price is asked. In placing a contract this point should be kept in mind and whenever the difference in price is not too great, preference should be given to the company that is most able to keep you supplied with coal at such exceptional times. If you expect fair treatment from the coal company you must treat it fairly by living up to your part of the contract whether the price falls or rises during the continuance of the contract.

When plants are at any great distance from the mines it becomes necessary to store a considerable quantity of coal. This involves additional expense due to the extra handling, value of storage space, and loss of coal both mechanically and chemically. The loss due to oxidation or weathering of coal not only reduces the calorific value of the coal but as the temperature of the pile rises, the oxidation becomes more rapid until the ignition temperature is reached and much additional labor and expense is necessary to prevent the burning of the coal and often the destruction of other property. There are many theories as to the cause of spontaneous combustion in coal piles and several remedies have been tried with more or less success. Storing coal under water

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seems to be the only method of absolute prevention. Sulphur is generally referred to as the cause of spontaneous combustion, but each per cent. of sulphur if burned completely and no heat was radiated from the pile during the slow combustion, would raise the temperature of the pile only 200 degrees Fahrenheit. Many cases of spontaneous combustion occur in piles of coal that contain less than one per cent. of sulphur, and analysis of coal from heated piles show that only a small percentage of the sulphur has been oxidized. Some heat must be radiated from the pile and a temperature considerably above 200 degrees Fahrenheit, is necessarily reached. Should the sulphur exist in the form of pyrites and both the iron and sulphur oxidize, the heat generated would not be great enough to cause the temperature of the pile to rise as high as 550 to 600 degrees, which temperatures have been reached before the coal really ignited. Excessive moisture may play some part in causing spontaneous combustion, but exceptions to this are many. The height to which the coal is piled is generally considered a very important factor, but frequently the hottest part of a pile twenty feet deep is within three feet of the surface. In one case a pile of coal ten feet deep took fire about six feet below the surface and in another part of the same pile the coal was thirty-five feet deep with no signs whatever of heating. Some coals store better than others, the reason for which seems to depend upon its physical structure rather than the chemical composition.

It seems that the rate of circulation of air through a coal pile has more to do with this question than any other condition outside of the character of the coal. The heating is mostly very irregular throughout a pile, as there are usually spots where the temperature is much higher than in the surrounding space. For this reason the usual method of taking temperature measurements in a pile by letting a thermometer down a set of pipes scattered throughout the pile is very unsatisfactory as the hottest spot that will soon cause trouble may be missed entirely. The question, what is the safe limit for the temperature of a coal pile, is frequently asked, and it is rather difficult to answer for a coal pile may heat up to a pretty high degree, then cool down without being moved. But if there is enough heat generated to raise the temperature of the coal pile to 212 degrees Fahrenheit, the moisture being evaporated at or before this temperature is reached leaves only the dry coal, which has a comparatively low specific heat, to be heated. The heating takes place much faster and the rate of

oxidation also increases with the rise in temperature. The carbon in the coal evidently oxidizes to a considerable extent, as large percentages of carbon dioxide have been found in coal piles at comparatively low temperatures.

(b) Many plans are so limited in boiler capacity, have such poor draft, or some kind of grate or stoker that it is possible for their boiler room force to keep steam with only certain kinds of coal. While this is not an ideal state of affairs it is a condition that exists in a large percentage of the power plants in this country and unless a man knows what coal will develop the required boiler horse power in his plant he may have the costly experience of shutting down a part or all of his mill. There is a great deal of difference in the rate of combustion of different coals. The percentage of volatile matter, coking properties, amount and nature of ash are the principal factors upon which depends this characteristic in various coals. It is not always the better or higher priced coals that give the best satisfaction under such conditions, for a cheaper coal might give more satisfactory results than are being obtained with the highest priced coal on the market, but the risk of experimenting has seemed too great for the management to consider stepping out of the well beaten path.

(c) All minerals or raw material are bought because they contain some one ingredient or property that may by a certain treatment or operation be enhanced in value or utilized by the manufacturer in such a way as to cause him to make a profit from the principal product of his factory. It is seldom that any mineral or raw material does not contain some impurity or inert matter that may involve additional expense for its riddance or by a certain process may be converted into a by-product and thus become a secondary source of profit. Coal varies more in character and quality than any other mineral produced. In character it is found in all successive stages between lignite and anthracite. Each different kind is more applicable for one purpose than another. In selecting a coal for making illuminating gas the yield of gas measured in "candle feet" is of primary importance, while the coke and tar are by-products, and sulphur is the impurity, that causes additional expense. For making coke the purity, structure and yield of coke are the properties to be considered, and the gas, tar and ammonia may be utilized as by-products. In buying steam coal the amount of heat that may be developed from it is the measure of its value to you. There is no by-product that may

be utilized, except that in some cases the sale of ashes might be considered in this connection, but their removal is generally an additional expense. Two coals at the same price and containing the same number of heat units may not be equally desirable. The difference in volatile matter might cause the lower to prove more satisfactory under certain conditions of smoke restriction, while the higher volatile coal would probably be more applicable in a plant with fluctuating load. The amount and nature of ash in regard to the formation of clinker often needs to be considered.

The liability of spontaneous combustion of one coal more than another may make it advisable to pay several cents per ton more for one coal containing no more heat units than the other.

The following table shows the analyses and results of evaporative tests of some of the better coals together with their price f. o. b. cars at the plant of an inland New England mill. The relative values have been calculated by taking coal A as a basis and determining what will be the cost of the equivalent amount of coal required to produce the same number of heat units as coal A produces for \$4.60 per ton. For example, should you buy coal F at \$4.40 per ton your coal bill would amount to the same as if you had bought coal A and paid \$4.92 per ton for it, but as you can get coal A for \$4.60 you would save 32 cents per ton by taking coal A instead of coal F at the given prices.

In this case it appears that neither the best nor the lowest priced coal would be the cheapest to buy.

Coal	Moisture	Volatile	Fixed Carbon	Ash	Sulphur	B. t. u.	Lbs. water evaporated from and at 212° F.	Price f. o. b. plant	Relative Cost per ton with Coal A as basis	
									By B. t. u.	By evaporation
A	1.25	17.94	73.15	7.66	2.07	14354	9.93	\$4.60	\$4.60	\$4.60
B	1.43	17.59	71.58	9.40	1.09	14032	9.73	4.55	4.65	4.64
C	1.17	30.51	61.01	7.31	0.99	14251	9.79	4.65	4.69	4.71
D	1.36	16.42	71.35	10.87	1.77	13811	9.60	4.58	4.76	4.74
E	1.75	19.58	71.95	6.72	0.82	14533	10.03	4.86	4.80	4.79
F	3.72	21.06	66.90	8.32	1.36	12834	8.80	4.40	4.92	4.96
G	1.74	31.16	53.68	13.42	2.93	12833	8.67	4.60	5.14	5.27

In this table the coals are arranged in order of cost for equal amounts of heat generated and equal evaporation, but in selecting a coal for any particular plant it might be policy to select a coal that would cost a little more money in order to obtain some par-

ticular advantage that a certain coal might have over another. Comparing coals A and B, coal A appears to be better in every way except that it contains about one per cent. more sulphur than does B. For steam purposes the sulphur is of little importance below two per cent. at least, so that coal A would probably be selected on account of its being five cents per ton cheaper on a heat unit basis and there would also be less ash to handle. In case a plant had limited draft and boiler capacity a coal like C might be selected in preference to B or even A with a difference of nine cents per ton in favor of coal A. Should the prevention of smoke be an item of considerable importance coal D would probably be purchased at an additional expense of seven cents per ton as compared with coal C. Of the two coals D and E there is a difference of only four cents per ton, and that would scarcely pay for the additional cost of handling ashes, the possibility of not being able to carry the load without the use of more boilers, and other expenses that are greater with a poorer coal.

While coal E is the best all round coal it would not pay to purchase it when coal A could be obtained for 20 cents per ton cheaper on a heat unit basis, and 19 cents per ton cheaper on an evaporation basis.

Coals F and G are both much inferior to the others and their purchase would not be considered when any of the other coals were available at the given prices. Judging from the ash and sulphur alone it would seem that coal F would be better than either B or D, but a certain characteristic appears in this coal that makes it different from any of the others. It is "crop" or "red" coal coming from a part of the seam near the out-crop and has become saturated with the surface water that has been percolating through it for hundreds of years. The moisture is much higher than in any of the other coal and it contains a still larger percentage of combined water that is not driven off by the mere drying of the coal. If a man were depending upon the ash determination alone he would never detect that he was receiving an inferior quality of coal; in comparison with coal A he would be paying 20 cents per ton less for the coal yet he would have to burn so much more of it to develop the same horse power that he would actually be losing 32 cents per ton, or \$16,000 per year on a 50,000 ton contract.

Coal G is high in ash and sulphur and correspondingly low in B. t. u., so that it would be a very expensive fuel to burn at the price quoted, and in comparison with the other coal you would not

consider it. Yet there are thousands of tons of it being burned and the manufacturer seems to be willing to pay the price.

In the preceding table the equivalent evaporation in pounds of water from and at 212 degrees Fahrenheit is given as determined in carefully conducted boiler tests on the same boiler. They represent the average of two or more tests under as nearly identical conditions as it is possible to maintain, thus accounting for the closeness of their comparison with the B. t. u. determination. Duplicate boiler tests on the same coal frequently vary five to ten per cent. even though the method of firing and the rate of combustion have changed as little as possible. The chemical analysis and calorimetric determination will represent the value of coal within one per cent. providing the samples are properly taken. The plea for evaporative tests because they are practical is counterbalanced by their failure to burn the coal under equally comparable conditions in two or more cases. A fireman must become accustomed to different coals and find wherein they must be handled differently in the firebox in order to obtain the best evaporation from each. The laboratory tests are generally considered as theoretical and unreliable. But theory and practice always agree when they both represent the facts.

After the most economical coal has been selected, it remains for the manufacturer to see that such coal is delivered. Throughout the year the coal company may send coal of different quality from other mines, or the quality of the coal from the same mine may change, due to impurities encountered in the seam or lack of preparation at the mine. The coal operator may know the change in quality as many of them follow up their product by chemical analysis and inspection much more closely than does the purchaser, but it is the manufacturer's place to know what he is getting and prove to the coal company that the coal has changed and that he is not receiving the coal he is entitled to by the contract. The results of an evaporative test mean but little to anyone except the man who conducts them, and apply only to the one plant and set of conditions under which they were made, while the analysis of coal is now on such a standard basis that the results are comparable whether the sample is taken at the mines, en route, or at the destination. There are many analyses published and given out by a large number of coal companies that represent selected samples of the coal from certain parts of the seam that are absolutely valueless as representing the quality of coal actually loaded at their

tipple. Such a policy is short sighted and is fortunately disappearing, for the consumer is going to find out for himself when the coal reaches his plant, and the comparison of results is generally to the discredit of the coal company. But the person who has suffered the most from this practice is the coal man who does give representative figures, for he is judged by the consumer as also giving fancy results and allowance is wrongly made for shrinkage. The present day tendency is to buy coal on a B. t. u. basis, adjusting the price for the coal delivered in accordance with its quality. The advisability of carrying this into effect depends upon the tonnage, method of delivery, and difficulty in otherwise obtaining a uniform product. The fact that a coal company knows their coal is being systematically analyzed is generally sufficient to ensure the delivery of coal of uniform quality.

In addition to knowing what is the most economical coal to buy, the manufacturer must know—

(d) How to convert a large percentage of the heat energy of the coal into useful work. The efficiency of a boiler plant depends primarily upon the completeness of combustion of the fuel and completeness of absorption of the generated heat by the water or steam in the economizer, boiler or superheater. It is impossible to generate into available form all of the heat energy of the coal. Some coal and carbon are lost with the ashes, while combustible gases and carbon in the form of smoke usually escape unburned to a greater or less extent. The loss due to incomplete combustion depends largely upon the design of the grate, furnace, and combustion chamber, as well as the proportionate rate and method of supplying coal and air to the furnace.

There are so many kinds of mechanical stokers, special furnace designs, fuel saving devices and smoke preventers on the market that the manufacturer is at a loss to know which one would give the best results in his plant or whether it would pay at all to change from the old hand fired stationary grate. Many people install a certain appliance because it has given satisfaction in some plant known to them. They do not stop to consider that their conditions may be different, they may have a more fluctuating load, it may not do equally well with the coal they want to burn, or they may not have men of the necessary intelligence or experience in their boiler room to successfully operate the appliance. A mechanical stoker that does very satisfactory work when one kind of coal is being burned may fail when fed with another coal. The

fault does not lie in the stoker but in the judgment of the man who tried to burn a certain coal on it under certain conditions. A man, hand firing a stationary grate also frequently fails to keep steam with one coal when he could with another. It may or may not be the fault of the fireman, but such difficulty is usually due to his unfamiliarity with the coal, and he tries to fire it in the same manner he has been accustomed to firing the coal he has previously used. If two firemen, one having always burned a good coal that formed practically no clinker, and the other a coal which clinkered badly, should both receive the same kind of coal of medium quality, one might fail to keep steam and the other would consider that it was of very good quality. In many cases it would pay to make changes in the boiler plant or add more boilers so that the most economical coal could be burned regardless of its quality, as well as to secure as nearly complete combustion as possible.

The question of smoke prevention must receive more consideration from the manufacturer in the future than it has in the past. While it may not be possible or economical to prevent the last traces of smoke, yet there are many stacks in different parts of the country that issue so little smoke that they are not at all objectionable. In most cases where other than anthracite coal is being burned the prevention of smoke has been accomplished by means of furnace design and the method of firing.

After combustion has taken place the heat of the coal appears in the form of sensible heat in the gases leaving the furnace or combustion chamber. The important problem is to cool the gases as much as possible with a minimum of boiler heating surface. In order to accomplish this the heating surface should be kept clean inside and out. Too much emphasis cannot be put on this point. Combustion is more complete with considerable excess air, but this excess air passing through the furnace reduces the temperature of the gases approaching the boiler and the temperature of the escaping gases remains about the same so that a larger percentage of the developed heat is lost up the stack. This condition might be compared with a steam engine running with low initial pressure and exhausting against a high back pressure. The amount of air excess is regulated by the intensity of draft and condition of the bed of fuel. Few firemen have ever had the opportunity of learning what was the best thickness of fire or intensity of draft under the conditions existing in their boiler plant when burning a certain

kind of coal. Many people think the stronger the draft the better, but there is opportunity to save thousands of dollars every year in many plants by merely reducing the draft or better regulation of it. The installation of a damper regulator is not always the remedy for they often cause more loss than occurred when hand regulated dampers were used.

The analysis of the flue gases is the best criterion for regulating the conditions of a furnace so as to obtain nearly complete combustion with a minimum of air excess. The perfecting of automatic gas indicators and recorders will do very much toward increasing the boiler room efficiency.

No one kind of boilers or heat absorbing apparatus will give equal satisfaction in all plants. This depends upon location of plant, kind of water, uniformity of load, kind of coal, etc., and must be determined in each individual case.

It may seem unnecessary to investigate so thoroughly what would be the most economical fuel, how it can best be burned, and how the largest percentage of the heat can be converted into useful work, but the money saved by doing so, even in the smaller plants, amounts to a surprising sum in the course of a year. The manufacturer who is too busy enlarging his mill and increasing his output to give corresponding attention to his boiler room usually regrets the mistake when all his labor is standing idle for lack of power or the coal bill becomes a disproportionate percentage of his cost of operation.

News from the Companies

BOSTON OFFICE.

At the recent meeting of the National Electric Light Association held in Chicago, one of the most important committee reports was that of the committee on the Grounding of Secondary Alternating Current Systems, of which Mr. W. H. Blood, Jr., of our Boston office, was chairman. After the report, which included a proposed rule bearing on this subject, was presented, the following resolution was unanimously accepted: "Resolved, That it is the sense of this meeting that it is desirable to have inserted in the National Electrical Code a rule making mandatory the grounding of alternating current secondary circuits up to and including 150 volts, and a provision making prohibitory the grounding of secondary alternating current circuits carrying in excess of 150 volts." The permanent and proper grounding of secondary alternating current systems removes most effectively the danger to the life of customers which might be occasioned by faulty transformers or crosses with high tension wires. The action of the committee is to be commended, and it is hoped that the underwriters will forthwith revise their rules to meet the suggestions of the committee.

Mr. Tripp went to Minneapolis in the second week of the month.

Mr. Herbert S. Whiton, having been married during his visit here, went back to Porto Rico early in July.

Mr. Stone, just after the Fourth, began a considerable period of vacation. Mr. Webster returned, and with Mr. Robb and Mr. Bradlee has been in the office of the firm.

The librarian, Mr. Lee, attended the National Conference of Librarians at Lake Minnetonka, Minneapolis, through the last days in June and found time to give an interesting talk to the employees of the Minneapolis General Electric Company.

The index to Vol II of the Public Service Journal was sent with the July issue. Those who wish to complete their sets for

binding can probably obtain the needed back numbers by addressing Stone & Webster Library, 147 Milk St., Boston.

Mr. Lee H. Parker, railway engineer of the Engineering Corporation, recently spent two days looking over the route of a proposed interurban electric railroad between Concord and Dover, N. H., a distance of about 40 miles.

Mr. D. P. Robinson, president of the Engineering Corporation, and G. O. Muhlfeld, construction manager, returned to the Boston office early in July from western trips in the interests of the Corporation.

Mr. F. R. Coates of the Engineering Corporation left Boston July 14th, going first to New York, and thence West on matters of new business. He has recently been engaged upon an important new project which is now closed.

The United Missouri River Power Co. has retained the Engineering Corporation as engineers and constructors to build a 20,000 H. P. dam for the Helena Power Transmission Co. at Hauser Lake on the Missouri River near Helena. This work will be begun immediately. Associated interests have also retained the Engineering Corporation to design and construct a plant of 30,000 H. P. with a large dam at Wolf Creek, also on the Missouri River a few miles above Hauser Lake. This work will probably be held off for a few months. The developments will furnish power by high transmission lines to Helena and to Butte, the latter being some 60 miles distant from Wolf Creek site.

The power will be used largely for mining purposes. It is estimated that the total cost of the two projects will be in the vicinity of \$3,000,000.

Mr. G. O. Muhlfeld and Mr. E. B. Bumstead of the engineering department left Boston for Montana in connection with the Hauser Lake development on July 16th and 20th respectively.

Mr. Walter Goodenough of the Engineering Corporation left the Boston office on July 14th, going to Birmingham, Ala., and stopping at Philadelphia, Baltimore and Washington en route.

The Tampa Company has arranged with the Engineering Corporation for the extension of the building of the West Jackson Street Power Station and the installation of a 1500 Kw. turbine unit and boilers, condensing apparatus, coal and ash handling apparatus, coal bunkers, a new exciter set, and switching apparatus, and also for alteration and repairs in alternating current lighting and power distributing systems. The building extension will be

sufficient to house two 1500 Kw. units with 1000 H. P. boilers. At present one boiler of 520 H. P. will be installed. The Corporation is investigating the advisability of oil fuel for this plant. Should oil be adopted, the space which is now assigned to bunkers will be utilized for additional boiler capacity. It is estimated that this work will cost in the neighborhood of \$300,000.

Mr. E. C. Macy of the engineering department of the Corporation has gone to Helena in connection with the engineering of the Hauser Lake Dam.

Mr. D. W. Hartzell, Cornell 1908, has entered the statistical department.

Mr. S. B. Tuell, formerly superintendent of lighting of the Terre Haute Traction & Light Co., and recently at Fall River, has returned to this office where he will take up special work.

PADUCAH, KY.

The Fourth of July was celebrated with great zest in Paducah. The railway company handled the largest crowd ever transported on the Fourth, without accident of any kind.

Immediately after the Fourth preparations were made for the Kentucky, Tennessee and Mississippi Travelling Men's Convention. The town was all in red and white for them on the 9th, 10th and 11th. A large number of travelling men were here. Excursions were run into the city by way both of the railroads and the river.

HOUGHTON COUNTY, MICH.

The restraining order issued against the street railway company to prevent the crossing of the proposed Calumet & Lac la Belle Railway has been dissolved by the United States circuit court at Grand Rapids. This order, which was originally issued by Judge Loyal Knappen of this court, was thrown out on the grounds that The Houghton County Street Railway Company had prior rights at the point in question. Work, which had been held up on this account, has now been resumed.

The condemnation proceedings also instituted by this same company against the Calumet & Hecla, Tamarack, Osceola and other mining companies and interests in the same vicinity have terminated in the circuit court. These proceedings were to enable this new company to procure a right of way between Calumet and Mohawk for the purpose of operating an electric railway. The petition of the company was denied and the action dismissed. It is now probable that the matter will be taken to the State supreme

court. This, however, will not affect in any way the building of the extension between Wolverine and Mohawk by The Houghton County Street Railway Company.

Mr. F. O. Mayotte, manager of the Electric Park, the summer resort of the street railway company, reports that in the month of June the attendance reached 15,889. During the month there were three band concerts, ten free dances and four private dances. So far in July some of the free dances have drawn over 1000 people.

The contract for paving Hecla street in Laurium has been let to R. S. Blome & Co. of Chicago. This pavement will be of granitoid, the same as now used in Hancock and Red Jacket, where good results have been obtained. It is hoped that in the village of Laurium it will not be necessary to stop the cars from running during the work. This has been done in one or two cases in the past, and has inflicted great hardship not only upon the railway company but also upon its patrons.

The railway, as a whole, has been put in first-class condition for the summer. During the spring the overhead has been thoroughly overhauled; the rails have been re-bonded where necessary and new switches placed on some of the turn-offs.

Plans have been drawn up and material ordered for the construction of a new 11,000 volt, three-phase transmission line between Laurium and Mohawk. This district is at present served by a single phase, 2300 volt line. The intention is to establish three main distributing points at three general locations—Wolverine, Ahmeek and Allouez, and Mohawk. At these points high tension pole transformers will be put up and the current distributed primarily at 2300 volts. From this, as necessary, it will be stepped—down to 220 and 110. With the installation of this line the service of the Northern district will be greatly improved. In fact, it should be as good as any in the Copper Country. The necessity of this line was demonstrated last winter, when by the increase of business it was found impossible to maintain as high a voltage as desired at the end of the line.

Considerable maintenance and improvement work was finished during this month. The underground system in Red Jacket was improved by the installation of a ground wire, to which all sheaths of cables were grounded. Also on this system the cable at the man-hole has been most thoroughly insulated and water proofed by the use of asbestos tape. The high tension transmission passing

through Lake Linden has been thoroughly overhauled. It has been found absolutely necessary to replace some cross-arms and set a few new poles. Many of these arms were found in very bad condition and probably could not have lasted through another winter.

The Red Jacket and Laurium village councils at their July meeting granted to the Calumet Gas Company, which supplies these two villages with gas, an increase from \$1.20 to \$1.40 per 1000 cubic feet. This gives the gas company a net increase of 17 cents per 1000, making their net rate now \$1.25, against the original rate of \$1.08. The original price was regulated by the franchise, and in order to allow this increase it was necessary to remodel the same. One other clause was also added, to the effect that at such time as the gas company is able to pay a dividend of eight per cent. on its outstanding capital stock, besides creating a sinking fund for depreciation and replacement and retiring outstanding bonds, it shall reduce the price of gas until it reaches \$1.20 net per 1000 cubic feet. This remodeled franchise will go into effect immediately upon acceptance of these rates by the company, and this, we understand, is to be done at once.

Mr. F. S. Pratt, vice-president in charge of the Houghton companies, visited with us three days in the latter part of June.

(P. A. Staples.)

MINNEAPOLIS, MINN.

On July 10th, Mr. W. D. A. Ryan, illuminating engineer for the General Electric Company, addressed the members of The Minneapolis Electrical Club on the values of effective illumination. Charts and diagrams illustrated the various uses and methods of obtaining the best results with given conditions. A portion of the address dealt with the tungsten lamp and tungsten diffuser. An interesting statement was made by Mr. Ryan to the effect that although the tungsten lamp has now reached a very high stage of efficiency, yet in the near future improvements on the arc lamps will increase greatly their standing, and will undoubtedly accomplish more than the tungsten has effected. The General Electric Company is at the present time experimenting on lamps with this idea in view.

The new ornamental street lighting on Nicollet Avenue is exciting very favorable comment throughout the city. Many more blocks along this avenue have been contracted for, together with several of the cross streets and Hennepin Avenue, which runs nearly parallel to Nicollet Avenue, in a business way the two striving

for leadership among the retail stores. The introduction of the new lighting on one street immediately induced the storekeepers of the other to follow the example of their neighbors—bearing out the assertion that trade follows light. These two avenues starting at the same point form the gateway to the city, and, diverging for several blocks, will present a very attractive appearance to the visitor entering the city either by day or night. The number of posts already contracted for erection is over twice the number at present installed. This in itself speaks well for the near future and the extent to which the new system is likely to be utilized.

There has recently been completed fifteen miles of overhead grounded wire for lightning protection on the St. Croix-Minneapolis transmission line. This completes the present installation of lightning protection along this high tension system. Results have already shown a very marked change in the operation of the St. Croix plant and at the transformer sub-station at the city end of the line. Notwithstanding the fact that for nearly two months and a half this portion of the country was visited almost daily by rain, followed by thunderstorms, no interruption to service has followed. A continuance of the present operating conditions for the remaining months of the summer, will testify to the success of overhead grounded wires as the only safe and effective system of lightning protection. No insulators have been punctured since the new protection has been installed.

A 250-watt General Electric Tungsten lamp has recently been received, and is now on test in our show-window. A special holo-phane bowl distributing globe is used in connection with this lamp.

Under the direction of our superintendent of power, a coal test is being run in our Main Street generating station, for the purpose of deciding upon the most economical coal to use and the method of firing to be adopted. A new system of coal delivery, purchasing and storing, is being devised by our general superintendent, which it is hoped will greatly reduce the cost of coal at the boilers which is necessarily high in this portion of the country.

An interesting factor in hydraulics has recently presented itself here at the St. Anthony Falls in connection with our Main Street water turbines. With the completion of a very fine piece of engineering work under the direction of The Twin City Rapid Transit Company—an 8000 H. P. hydro-electric plant just adjacent to our station—we find that the efficiency of our water wheels has materially increased,—due to the fact that the new station,

when operating, changes the general course of the river, driving it farther to the east and increasing the speed of the water as it enters the pen-stocks, and also by erosion and by suction greatly aiding in eliminating a certain back pressure which existed in the tail-race, especially at high water periods.

At the present writing there are in the St. Croix River 42,000,000 feet of logs. These logs form rafts, which extend for three miles above Nevers Dam and for two and one-half miles above the power dam at Taylors Falls.

Mr. James Sargent, manager's secretary, is spending a few weeks' vacation at his former home in Gloucester, Massachusetts.

Mr. Conant, of the contract department, left on July 18th for his vacation on one of the many lakes just outside the city.

During the past few months a very careful inspection of the fire apparatus has been made, resulting in the addition of various new appliances in the different stations.

A notable addition that has recently been made to our connected load is The Minneapolis Club house, a business-men's club of this city. Approach was made to the building through underground conduits. This building is a four-story brick structure of English design and is a great addition to our already beautiful city.

At St. Paul during the week of July 12th there were 40,000 Shriners assembled in national convention. Many hundreds found their way into Minneapolis every day and were highly impressed by the new ornamental street lighting system, which, in honor of the event, was made more effective by thousands of incandescent lamps festooned along the main street.

Mr. Gardner Rogers, general superintendent of this company, was the guest, during a three days' vacation, at the camp of the First National Guard of Minnesota.

This company recently had the pleasure of a visit from Mr. G. E. Tripp and daughter and Mr. O. D. Young.

Mr. George Giddens, storekeeper of The Dallas Electric Light and Power Company, visited this company while attending a theatrical managers' convention in this city.

Mr. George W. Lee addressed the members of this company on June 25th on the value of the Stone & Webster Library to its employees.

It is of considerable interest to note that the power business, which for many months has been lagging because of the economizing tendency resulting from the recent financial unrest, is now

showing very encouraging signs on the upward side. Elevators and large industrial corporations using great quantities of power, are now taking their full capacities, and in many cases have signed contract greatly to increase their demand. Their output has reached its former standard, and in general a prosperous outlook presents itself.

(R. H. McGrath.)

DALLAS, TEX.

On July 1st the Texas Traction Company began operating cars over its new Interurban line between Dallas and Sherman. The day previous special cars carrying a party of officials and stockholders made a trip over the line, and the next day the road was opened for business.

While the Interurban cars are not yet running into the city because of the connections with the local lines not being completed, passengers are transferred at the city line to a special car reserved for the purpose and are brought into the city. Work is being pushed as rapidly as possible on the terminals and on the connections with the tracks of the local companies, and large cars will run into the city by July 12th.

Dallas has just had one of the most destructive floods in her history. The Trinity River, which separates Dallas from Oak Cliff, and is ordinarily a small and very harmless looking stream, swollen by the unusually heavy spring rains in this section of the country overflowed its banks, reaching the unusually high mark of 52.6 ft. at 5 P. M. on May 25th, 1908, which was the crest of the flood. Shortly after this the waters began to recede slowly.

In view of the fact that only a few weeks previous the river had been at the flood stage no one anticipated another freshet and the unusually rapid rise on the night of Sunday, May 25th, and Monday morning took many people who live along the river banks and in the bottoms unawares, so that they were compelled to flee from their homes without being able to save any of their belongings. At 2 A. M. Monday morning the river had reached the 35 ft. stage, and was rising at the rate of three feet per hour; at 3.34 A. M. the entire station of the Dallas Electric Light & Power Company shut down, as the waters had submerged some of the machinery and had entered the furnaces.

With the shut-down of the power station, Dallas was left without street lights and power, and only such houses were lighted as were supplied with gas or had service from the Dallas Ice Factory, Light & Power Company. The street car service was badly

crippled, although through our connections with the plant of the Dallas Ice Factory, Light & Power Company, located in East Dallas, we secured sufficient D. C. power to operate 32 cars out of 54 cars usually operated. Only slight damage was done to the tracks of the street railway company, where in some sections they were submerged by the water, so that through service on the South Belt line, also on the Lake Avenue, Fairland and Oak Lawn lines, was interrupted for a short time. The best service possible, however, was maintained on all lines, and during the day cars carried crowds of people to see the river.

Shortly after the power plant went out, the pumping station of the city water works was forced to shut down, the water entering the furnaces and putting out the fires. This stopped the big pumps and left the entire city without water. For the purpose of fire protection all use of water for domestic purposes was at once forbidden, and temporary pumps were started pumping water from the river into the city mains, in order to provide sufficient pressure for use in case of fire. Fire engines were also stationed at different points in the city to pump water into the mains.

The mayor issued a proclamation ordering all business houses closed between the hours of 7.30 P. M. and 5.00 A. M., and the militia was called out to patrol the darkened city. Being without light and power and water, business was practically suspended, and thousands of people gathered at the river's edge to watch the flood. At about 10.00 A. M. Monday morning 2400 feet of trestle, which connected the steel bridge of the Texas & Pacific Railway Company going west to the fill across the Trinity bottoms, was swept away. There were several men on it at the time, who were thrown into the water, but it is believed that all were saved. This cut off railroad communication between Dallas and the West. The M. K. & T., the H. & T. C., the Santa Fe and the Cotton Belt roads were all unable to get trains out of Dallas on account of the high water. As the flood had submerged the tracks of the Northern Texas Traction Company street car service between Dallas and Oak Cliff was cut off and the only means of travel between the two places was by boat. The Oak Cliff cars were operated around Oak Cliff loop to the river, and the Interurban cars were run regularly from there to Ft. Worth.

While small homes all along the river banks and in the lowlands suffered greatly from the flood, the greatest damage to any one locality was in what is known as West Dallas, where many

small houses were flooded and in many cases swept away and lost or demolished.

The light construction in this part of the country rendered them practically unfit to withstand the rush of water, and the receding flood left a desolation of twisted and demolished houses where before had been happy and flourishing homes. Portions of North and South Dallas were also flooded and presented much the same appearance described above, only some of the houses here being of slightly heavier construction and more recently built stood on their foundations, with here and there a roof showing. In many cases furniture and other goods which were moved to the upper floors to escape the flood were covered by the water and damaged beyond repair.

Early Monday morning reports of families in danger and distress in West Dallas began to come in. Rescue parties were at once organized, and the work of taking people off of high places and roofs in boats began. All day long this was continued, the refugees increasing in numbers as the waters crept higher and higher. Relief camps were established and money was raised by popular subscription for the relief work.

As soon as the waters had receded sufficiently to make it possible, a large force of men was put to work at the power plant to clean and examine machinery and to get the plant into shape for starting again. Aside from the flood water, we had two other serious problems to deal with when it came to starting the plant; namely, the question of fuel and boiler feed water. Almost our entire storage supply of fuel oil had been carried away early Monday, as the unloading pipe had broken and had allowed the water to get into the oil tanks and force the oil out, so that hundreds of barrels of oil had floated off down the river. No oil could be brought from the Texas Oil Company's station in West Dallas, on account of railroad connections being cut off, so that our entire supply consisted of about 90,000 gallons in cars which happened to be here at the time and which we had not unloaded. Of this amount we were obliged to give the Dallas Ice Factory, Light & Power Company two cars of 12,000 gallons each, as their fuel supply was low, while their consumption had been greatly increased by the railway load. Fortunately, however, the Texas Company was able to get two train loads of oil, one of twenty cars, the other of ten cars, in over the Texas & Pacific from Louisiana before our supply was exhausted.

The question of boiler feed water was also a perplexing one as, while we have connections with the city water mains, there was no water to be had from them and both of our well pumps were submerged. The electrical pump was entirely unfit for service, but the steam pump was finally started under about ten feet of water and worked satisfactorily.

While all of the machinery in the old plant was entirely submerged by the flood, the foundations of the two 1500 Kw. turbines recently installed were sufficiently high that the water did not reach their electrical parts, and by installing a new exciter set, borrowed temporarily from the sub-station, we were able to start No. 1 turbine at 2 P. M. Thursday afternoon, and some current was furnished for residence lighting that night. Street lights were still impossible, however, owing to the fact that the tub transformers were completely submerged and the coils had to be dried out completely before they were fit for service. This drying out of the transformers, as well as of the other electrical apparatus, was accomplished by the use of electric car heaters, steam coils and gas burners, which were kept going night and day; so that by Wednesday, June 3d, we were able to supply three out of the nine arc circuits with power.

From that time on conditions at the power station have gradually improved, so that we are now running all of our regular cars and extras, and are handling the full arc light power and incandescent lighting load.

By Friday the water had fallen sufficiently to allow the Northern Texas Traction Company to work on their tracks across the Trinity bottoms, and although in some places the track was completely unfit for service, having been washed off the dump and torn from the trestles, one track was repaired temporarily, so that cars began crossing that night and the next morning regular service to Oak Cliffs was resumed.

Conditions in the city have become normal again, although it will take a long time to repair the damage to bridges and roads caused by the flood in this section.

Mr. Wallace J. Ivers, who for the last two years has been master mechanic for the street railway lines, has left Dallas for Lewiston, Maine, where he will fill a similar position with a system of city and interurban lines under the management of his brother.

EL PASO, TEX.

Signs of returning good times are beginning to be observable

in El Paso. The shops of the G. H. & S. A. railway have reopened on full time, and the copper mines and smelters at Cananea have resumed operation.

There has been considerable excitement in El Paso the last few weeks over the attempted revolution in Mexico. The revolution, which has been of very limited extent, has been largely exaggerated by the newspapers. It has, however, caused a good deal of uneasiness in Juarez, across the river from El Paso, many of the persons in that city having moved their families over to El Paso temporarily.

During the month of June the double tracking of Boulevard street was completed—a distance of about a mile and a half. This is a very much needed improvement, as three different lines operated on this stretch on a single track before the installation of a double track, making it practically impossible to make satisfactory schedule.

Washington Park is under new management this year, and, for the first time in its history, it is really being handled with energy and skill. This company has been obliged to operate the park for two years, with indifferent success, and we feel that with independent park management the proposition will hereafter be much more satisfactory from our point of view.

Mr. E. R. Adams, of the Boston office, was here during the month of June making the annual audit of the company's books.

The most disastrous cloud-burst of many years occurred in El Paso on the 2nd of July, 1.2 inches of rain falling in twenty-five minutes. One of our lines was so badly washed out as to be put out of business entirely for a day and a half, and the repairs of another line required three or four days, and the hauling of 800 cubic yards of dirt. The soil around El Paso, especially on the mountain sides, is for the most part of an almost impervious nature, so that the water runs off of it as from the roof of a house, making a very serious flood in all streets which happen to be located at the bottom of an arroyo. The cost of the storm to this company was about \$500.

(C. W. Kellogg, Jr.)

TACOMA, WASH.

For six years the weather has never been so unfavorable to travel upon the electric lines as during the past two or three months. This has had a tendency greatly to decrease our gross earnings. We referred to this in our last statement, and the

remarks are just as applicable now as then. On July 4th the evening was so cool that winter clothes were desirable, though the daily papers were at the time reporting deaths from heat in the Far East. If any of the people living east of the Cascade Range or the Rocky Mountains wish to find a climate that is perfectly cool both day and night, and where flowers bloom until Christmas, they ought to come to Puget Sound.

Some 8,000 soldiers will be camping at the government drilling grounds, near American Lake, after July 15th. A spur has been run off of the American Lake line, for a distance of half a mile, to the official quarters, and carload freight is already beginning to move to the end of this branch for government purposes. We expect to carry a large number of people to the camping grounds during the two to three months their maneuvers are going on. While the government has not as yet decided that these grounds shall be permanent, there is every indication that such will be the case, although California is making a hard bid to have them located in that State.

The present grounds, which are leased, are eight or ten miles square, extending half way between American Lake and Olympia. They are very well adapted to army maneuvers. Certain portions of the ground border on the Sound, which gives them connection with the naval vessels; and American, Steilacoom and Graveley lakes, which are composed of fresh water, with sloping shores in some parts and high hills in other places, are also a great advantage. There are miles of prairie in this vicinity, where fast marches can be made and automobile tests, etc., and there are excellent opportunities for sham battles,—certain regiments hide in the hills and the opposing regiments labor to find them, etc. All this is very interesting and should create considerable business, by exciting the interest of traveling public.

Mr. Frank L. Mallory, chief clerk to the assistant treasurer, was married to Miss Anna Allstrum, May 30th. Miss Allstrum was formerly stenographer in the treasurer's office.

We had a very pleasant letter and a pamphlet with fine cuts, showing the streets and prominent buildings of Manila, from Mr. J. Russell, formerly head bookkeeper in the treasurer's department at Tacoma. Mr. Russell is now treasurer of the electric railways in the city of Manila. It would appear that vast improvements are going on in the electric railway field in that far-away city.

The races at Seattle—the race track being located on the lines of the Puget Sound Electric Railway—are now going on, and will continue for the next couple of months. The attendance compares favorably with last year. As a number of racing courses are closed throughout the country, some of the finest horses on the track are now appearing at the Meadows.

The Fourth of July passed off very quietly in Tacoma, orders being issued by the mayor and chief of police against the use of cannon crackers, dynamite canes and heavy explosives on the principal streets of the city. The difference, in comparison with past years, was very great, the main thoroughfares being almost deserted. The public amused themselves by going to the different resorts on the outskirts of the city.

The parlor cars are still a great attraction on the interurban.

All of the condemnation suits for rights of way for the new line between Tacoma and Puyallup have been tried, the railway company now having the right to enter upon the premises and begin construction of the road, which is to be finished by December. The line when completed will be one of the most modern in the country. It will have practically not a single curve from the time it leaves the main line of the Interurban until it reaches the Puyallup river near the city of Puyallup, and excellent time can be made over the route when the service is begun.

The city of Tacoma still has the paving fever; it would seem that nearly every street is being paved. It adds, of course, greatly to the beauty of the place and induces a great deal of automobile travel. On the other hand it increases taxes and advances the price of property in many cases to such an extent that it is a question whether, in the outer districts, it will not have a tendency to retard progress.

During the past month serious accidents have shown a decrease and a number of cases have been won in the courts.

(W. G. Dimmock.)

SEATTLE, WASH.

We had a visit during the month from Mr. D. P. Robinson, president of the Stone & Webster Engineering Corporation, who had been spending some weeks in California. With Mr. Robinson were Mr. Hunking and Mr. Muhlfeld, of the Engineering Corporation, Mr. Chandler Hovey, of Kidder, Peabody & Company, and Judge Rice, of Gaston, Snow & Saltonstall. Mr. Shuffleton had gone down from here to be with the party in California and accompanied them to Seattle. The day after their arrival, together with Mr.

Dabney, Mr. Lukes and Mr. Whitson, superintendent of the Engineering Corporation at Seattle, they visited the proposed development of White River Plant at Lake Tapps. The next day some of the party visited the water power plant at Electron, and the others visited various points of interest in Seattle.

Mr. A. L. Kempster, our superintendent of transportation, left Seattle on June 20th for a trip to Minneapolis, St. Paul, Kansas City, Denver, and other cities of the Middle West, for the purpose of studying different methods of operation. He reports a very interesting trip, which will doubtless be of great benefit both to Mr. Kempster and to the company.

Mr. L. L. Elden, of the Edison Electric Illuminating Company, of Boston, is now in the city, and is visiting our various power houses, sub-stations, etc.

We began operation on the extension of our Fremont avenue line to 75th street on Monday, June 15th. The opening of this extension has resulted in taking a considerable amount of travel from our Green Lake line, which heretofore has been somewhat overtaxed. Travel on the Fremont avenue line has been so heavy that it has become necessary to run a six-minute service during the rush hours of the morning and evening.

It has definitely been decided to hold the Alaska-Yukon-Pacific Exposition in 1909, as originally planned, and work is being rushed on buildings and preparations for the opening on June 1st of next year. The grounds are being laid out, flowers and trees planted, and with a few of the buildings already completed the Exposition site presents much of interest to the sight-seeing public.

BELLINGHAM, WASH.

Mr. L. H. Bean left Bellingham the latter part of June for a short vacation on the Eastern coast. He will visit Boston and New York and return about the 15th of July.

Mr. S. L. Shuffleton, of the Engineering Corporation, was in town for a few days in July on business connected with the proposed interurban to Skagit County.

During the business depression the people of this city have been taking advantage of the reduced prices of material and labor, and many new homes and public buildings have been erected. The city records show that since the first of January there have been 272 building permits issued, aggregating \$283,805. This does not

include two new business blocks that are just being started, one to cost about \$40,000 and the other \$60,000.

The employees of the gas department have recently organized a Shop Club, which meets bi-weekly in one of the larger rooms in the office and discusses matters pertaining to their work. At the last meeting, the superintendent, Mr. Clark, gave a talk on the manufacture of gas, enumerating the processes from the benches through the various apparatus to the holder. At the next meeting it is the intention to take up the different types of burners used in ranges, their consumption and efficiency. The meetings have aroused considerable interest among the men.

ELECTRON, WASH.

This extract from a personal letter written in Electron, Washington, where the new power development is in progress, to a member of the Boston forces, is interesting because it gives a whiff of Pacific coast activity and the viewpoint of the young man who sees that he is a part of the machinery that builds.

"I have been at Electron just five months now, the first four on top of the hill taking a course in practical hydraulics. When I arrived last November we had a big gang raising the sides of the flume from five feet to six. I went to work checking lumber, keeping the time and cost books, doing a little general designing now and then, and occasionally acting as a sort of subforeman over a small gang.

"I also spent a good deal of time getting used to spikes in my boots, and trying to look cheerful when I found myself out on the business end of a six inch beam with nothing in particular underneath for a hundred feet or so.

"On Christmas night we had a big slide at the Power House, the bottom dropping out of a small gulch which ran diagonally up the hill and opened out just back of the building. It landed a couple of trees up against the high tension switchboard, filled half the low tension buss room with eight feet of mud, and burned up or ruined a good deal of auxiliary apparatus—knocking the station out for twenty minutes. It took a month in the mud to get things straightened out again.

"On April 1st I came down to the power house to get inside experience and have had a month of wiping iron work from midnight till noon, and have managed to accumulate an incredible amount of grease and dirt in that time. I expect to have a try at running the machines from the floor in a short time, and to take shift at operating during the vacation period this summer.

"As you can see from the above, life here isn't lacking in excitement. It isn't bad at all after one gets used to missing meals or staying out all night in a storm, and things of that sort. We are distinctly out in the wilderness though, and I sometimes wish we could import some of the comforts and joys of Boston.

"I will give you the title deeds to my first bear—when I bag him. I have done considerable roaming around the country and so far have a deer and two cats to my credit, but no bears. But I have ambitions."

PONCE, PORTO RICO.

Mr. Thomas C. Keeling has recently joined our office force as cashier, succeeding Mr. Atherton Spaulding, who was compelled to return home on account of ill health.

Mr. J. H. Bissell, formerly with the Stone & Webster Engineering Corporation, and for a short while located with the Edison Electric Illuminating Co. of Brockton, has arrived to take charge of the customer's ledger.

All of the young men here are thoroughly enjoying the fine moonlight evenings for which Porto Rico is noted, either on the water or in horseback rides into the surrounding country.

The schooner "Governor Powers," scheduled to leave Newport News on or about May 16th with a cargo of 2600 tons of New River coal consigned to the Ponce Railway & Light Co. did not reach here until June 14th, almost two weeks overdue. We have all been much interested in her arrival, as Captain Kent and his wife are great favorites with the Americans residing here, and the many evening rides we have had in his fine large gasoline launch are events long to be remembered. She can easily carry twenty-five persons, and a trip to the neighboring islands is thoroughly enjoyed by all.

Business is not very brisk now, and as a number of the well-to-do families leave Ponce during July and August for their country houses, we expect but little change until September, or possibly the following month.

We have had considerable rain the last few weeks (prior to June 15), which pleases the planters immensely, and their good fortune is, of course, of benefit to us.

Collections are holding up well, but on all sides there is evidence of a money stringency, notably on the water front, where hundreds of peons gain a livelihood.

(J. B. Walker.)

SYDNEY, CAPE BRETON.

Business in the Maritime Provinces during the past month has been quiet. The weather has been exceptionally good and warm for this season of the year. There has been very little rain, however, which has caused more or less damage to the crops.

We have received and installed our new motor generator set for North Sydney station, and it is working very satisfactorily.

Three French warships are anchored in the harbor, coaling. They are en route to the tercentenary at Quebec, which takes place on July 23rd. The Frenchmen celebrated July 14th, the anniversary of the fall of the Bastille. The ships were thrown open to the public during the daytime, and at night the admiral's band furnished music in the Park. The ships were outlined in electric lights at night, which together with the searchlights and the fireworks made a very pretty effect.

Lord Falmouth, accompanied by Lady Falmouth and son, the Hon. Evelyn H. Boscawen, stopped in Sydney, to visit Louisburg. We are informed that Lord Falmouth is a grandson of Admiral Edward Boscawen, who was present at the capitulation of Louisburg in 1758. Lord Falmouth and party are en route to Quebec to attend the tercentenary celebration.

Commander Robert E. Peary is stopping at the Hotel in this city awaiting coaling and supplying of his steamer "Roosevelt," which arrived in port on the 14th instant. The "Roosevelt" expects to sail on the 16th instant on its long voyage to the Arctic circle.

Mr. B. E. Van Vliet, auditor from the Boston office, is auditing the books of this company and the Sydney & Glace Bay Railway Company, Limited.

(A. F. Townsend.)

Chase-Shawmut Co.

Mr. Moore is at present at the Newburyport office and for the time being is living at Salisbury Beach. Mr. and Mrs. Masterson are visiting him this week.

Fort Hill Chemical Co.

The new sprinkler equipment is in process of installation.

Low water prevails and the consequent slackness is being taken advantage of to make many of the improvements which will benefit the plant from the standpoint of fire risk.

Our purchasing agent, late of Salem but now of North Beverly, is a recognized authority on woodchucks and wood pussies.

CANTON, MASS.

Inspectors McLain and Seward of the Railroad Commission spent a few minutes with us last week on their way to Randolph.

C. H. Winslow, assistant treasurer, and George Spaulding, despatcher, have returned from the Street Railway Club outing at Portland.

During the severe shower, July 18th, the lightning went into our station and burned out three coils in our 300 Kw. machine. We will be obliged to run our small unit for power between Canton and Stoughton and buy the rest from Hyde Park for a week or ten days.

This company has adopted flags for following signs to take place of targets formerly used.

(F. T. Buchanan.)

COLUMBUS, GA.

The Columbus Power Company recently experienced a good deal of trouble with lightning entering the power stations over the railway feeders.

On June 4th the first of a series of accidents occurred, when the synchronous motor of the motor generator set used to supply power to the railway grounded in the stator. Luckily the machine was shut down before any serious damage was done.

Although this accident took place during a thunderstorm, the breakdown seems to have been due to a few of the lower coils being soaked during the recent high water. The machine is being operated with two coils cut out until permanent repairs are made.

During a storm on July 5th, lightning entered Station No. 4 over a railway feeder and grounded three armature coils on the D. C. side of the motor generator. Lightning entered Station No. 3 at the same time, but did no damage.

Lightning again entered Station No. 4 on July 17th, burning out about 50 coils in the steam driven railway generator.

Aluminum cell arresters have been ordered for the railway feeders, and it is hoped that they will prevent further shut downs from lightning.

The General Electric multiplex arresters installed on the 5500-v lines are giving satisfactory protection.

Mr. M. D. Dexter, superintendent of the gas light company, recently visited Birmingham for the purpose of studying the Alabama coal fields with Mr. Goodenough.

On July 23, Mr. J. P. Ingle, assistant superintendent of the gas light company, married Miss Gertrude Schomburg. During a ten days' trip they visited Macon, Tallulah Falls and Atlanta.

QUOTATIONS

ON

SECURITIES OF PUBLIC SERVICE CORPORATIONS

UNDER THE MANAGEMENT OF

OUR ORGANIZATION

JULY 20, 1908

NOTE:—Quotations are approximate. Unless indicated to the contrary Bonds and Notes are 5 per cent and preferred stocks 6 per cent non-cumulative. Accrued interest should be added to quotations on Bonds and Notes.

COMPANY	BONDS	PREF.	OOM.
Blue Hill Street Railway Co., The	95	No pref.	....
Brockton & Plymouth St. Ry. Co.	93 ¹¹	No pref.	....
Cape Breton Electric Co., Ltd.	90	75	15
Columbus Electric Co.	90	....	....
Columbus Power Co., The	93 Notes 95	....	....
Dallas Electric Corporation	7, 8 85	50 ³	15
Edison Elec. Ill. Co. of Brockton	105½ Notes 100	No pref.	151
Electric Light and Power Co. of Abington and Rockland	100	No pref.	150
El Paso Electric Co.	8 Notes 92½ 96 ⁴	85	41
Fall River Gas Works Co.	No bonds	No pref.	240
Galveston Electric Co.	92½	....	....
Galveston-Houston Elec. Co.	....	85 ¹	80
Houghton County Elec. Lt. Co.	97	22½ ⁶	13 ⁵
Houghton County St. Ry. Co., The	92½	92½ ¹	20
Houston Electric Co.	6, 7 98	....	....
Jacksonville Electric Co.	93	95	80

COMPANY	BONDS	PREF.	COM.
Key West Electric Co., The	....	....	....
Lowell Elec. Lt. Corporation, The	100	No pref.	185
Minneapolis General Elec. Co., The	98 Notes 100	100 ^{1, 6}	85 ⁶
Northern Texas Electric Co.	96 ² Notes 97 $\frac{3}{4}$	81 ⁷	80 ⁷
Pacific Coast Power Co.			56 ⁶
Paducah Traction & Lt. Co.	80	50 ^{1, 3}	15
Pensacola Electric Co.	95	75 ¹	20
Ponce Electric Co.	100 ⁴	No pref.	....
Puget Sound Electric Railway	97 ⁶ Notes, 1911 96 Notes, 1912 95	87	41
Puget Sound Power Co.	97 $\frac{1}{2}$	No pref.	....⁹
Savannah Electric Co.	80	50	12 $\frac{1}{2}$
Seattle Electric Co., The	1st m'tge 102 ^{6, 7, 8} Consol. and Refund m'tge convertible 96 " " " " non-con. 98 $\frac{1}{2}$ Notes 96 $\frac{3}{4}$	93 ^{6, 7, 8}	80 ^{6, 7, 8}
Tacoma Railway & Power Co.	95	No pref.	....¹⁰
Tampa Electric Co.	93 $\frac{1}{4}$	No pref.	103 $\frac{1}{2}$
Whatcom County Ry. & Lt. Co.	92 $\frac{1}{2}$	87 $\frac{1}{2}$ ¹	38

1.—Cumulative. 2.—Bonds of Northern Texas Traction Co. 3.—5 per cent. 4.—6 per cent. 5.—Par \$25. 6.—Listed Boston. 7.—Listed Louisville. 8.—Listed Columbus, Ohio. 9.—Held by The Seattle Electric Co. 10.—Held by Puget Sound Elec. Ry. 11.—4 $\frac{1}{2}$ per cent.

STONE & WEBSTER

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NOTE.—The Securities Department handles securities for those wishing to purchase or sell. Requests for information in regard to any of the above companies will be promptly answered at any time by this Department.

COUPONS AND DIVIDENDS DUE

	Per Cent.
Aug. 1st, Everett Railway, Light & Water Company, stock..	1
Aug. 1st, Fall River Gas Works Company, capital stock....	5
Aug. 1st, Houston Electric Company, preferred stock, 6 per cent.	3
Aug. 1st, Jacksonville Electric Company, preferred stock, 6 per cent.	3
Aug. 1st, Jacksonville Electric Company, common stock, 6 per cent.	3
*Aug. 1st, Lowell Electric Light Corporation, The, capital stock, 8 per cent.....	2
Aug. 1st, Minneapolis General Electric Company, The, preferred stock, 6 per cent.....	3
Aug. 1st, Minneapolis General Electric Company, The, common stock, 4 per cent.....	2
Aug. 1st, Houston Electric Company, 5's, 1925.....	2½
Aug. 1st, Key West Electric Company, The, 5's, 1956.....	2½
Aug. 1st, Pensacola Electric Company, 5's, 1931.....	2½
Aug. 1st, Puget Sound Electric Railway, 5's, 1932.....	2½
Aug. 1st, Puget Sound Electric Railway, 5 per cent. notes, 1911	2½
Aug. 1st, Puget Sound Electric Railway, 5 per cent. notes, 1912	2½
Aug. 1st, Seattle Electric Company, The, First Mortgage 5's, 1930.....	2½
Aug. 1st, Seattle Electric Company, The, Consolidated and Refunding Mortgage 5's, 1929.....	2½
Aug. 1st, Seattle Electric Company, The, 5 per cent. notes, 1911	2½
Sept. 1st, Galveston Electric Company, preferred stock, 6 per cent.	3

*This dividend has been made payable quarterly.

Sept. 1st, Northern Texas Electric Company, preferred stock, 6 per cent.....	3
Sept. 1st, Terre Haute Traction & Light Company, pre- ferred stock, 6 per cent.....	3
Sept. 1st, Edison Electric Illuminating Co. of Brockton, 5 per cent. coupon notes, 1921.....	21½
Sept. 1st, Whatcom County Railway & Light Company, pre- ferred stock, 6 per cent.....	3
Sept. 15th, Galveston-Houston Electric Company, preferred stock, 6 per cent.....	3

RECENT ADDITIONS TO THE LIBRARY

The Civic League of St. Louis has received from its Lighting Committee a report on street lighting in that city. The committee does not recommend either a municipal plant or competition between two or more private companies, but believes that reasonable rates and efficient service may best be obtained by a single company operating under the control of a public utilities commission.

The last report of the Massachusetts Board of Railroad Commissioners includes the usual tabulated statements and detailed reports for eighty-five street railways. A special investigation of fenders, both at home and abroad, fails to show any device that can always be relied upon to accomplish the desired result.

Some thirty volumes of the proceedings of various American gas associations have recently been purchased. The Library hopes to be able to prepare eventually a special index for this series of proceedings, most of which are not included in the general indexes of technical literature. It is possible that this index may be made available to the public if a sufficient demand therefor should be apparent.

The fifth edition of Foster's "Electrical Engineers' Pocket-book," of 1499 pages, recently issued (I. Van Nostrand Co., N. Y., \$5, subject to discount) exceeds by about six hundred pages the previous editions, an increase in bulk of 60 per cent. "The subject matter of every section has been completely revised or entirely rewritten."

The fifteenth annual volume of American Street Railway Investments, also called Street Railway "Red Book" (9½ in. x 13 in., pp. 473 + XLIV, 22 maps, McGraw Pub. Co., N. Y., \$5, with also a combination rate for subscription to St. Ry. Jrnl.) was issued early in July. It is "for the use of bankers, brokers, capitalists, investors, and street and interurban railway companies." It contains interesting historical, statistical, financial, equipment and organization data, presumably for all the electric railways of the United States, Canada, West Indies and American possessions, arranged alphabetically in the order of state, city and company.

LIBRARY

OF

STONE & WEBSTER

Current Literature

Selections from Recent Magazines and Book Accessions.

Ed, *, and + are used in cases of magazines to indicate editorial, illustration, and map or diagram, respectively. But these symbols do not have the same significance in the case of book numbers, all of which are preceded by an asterisk.

Concrete. (See also 13, 14)

- 1 Tests on plain and reinforced concrete. Series of 1906. Bond, compression & beam tests. MortonOWithey. Bull University Wis-11|07-1-66p*+ (Same) Series of 1907. B. U. W.-2|08-69-99p*+

Water Power; Central Stations, etc. (See also 17)

- 2 Water pr developmt in nat'l forests. A suggested gov't policy; method of fixing conservation charge & grants of rights-of-way. FGBaum. Procdgs Am Inst El'l Egrs-7|08-1217-8.7p
- 3 Double-deck stm turbine pr plts; the West Point station; auxiliary plt, Ft Wayne station; cost of completed pr station, 8,500 kw. JRBibbins. Procdgs Am Inst El'l Egrs-6|08-1251-19.7p*+
- 4 Gen equations of the el circuit; derivation; standing waves; traveling waves; free oscillations; transition points & the complex circuit; reflection & refraction of transition point. CPStenmetz. Procdgs Am Inst El'l Egrs-7|08-1121-74.2p+

Gas Engines, Fuel. (See also 21)

- 5 Some points in the design of large gas engines as exemplified in the Westinghouse horizontal type; fundamental differences between gas & stm cycle; valve arrangement; ignition & lubrication. Elec Jrnl-5|08-250-10p*+
- 6 Working results from gas-el pr plt; rept of 30-day test on service plt, Richmond Works Am Loco Co, Richmond Va; cost per kw hr & hp yr. JRBibbins. Procdgs Am Inst El'l Egrs-6|08-1271-11.8p+
- 7 Tandem gas engine at Watson-Stillman plt Aldine, NJ; cylinder constrn; valves & valve gear; ignition system. GWMalcolm. Power-5|5|08-683-4.4p*+

- 8 Fuels for pr: suction producer pit; liquid fuel engines; cost of fuel for pr per hp hr; extent of peat deposits; ammonia sulphate from peat; coal fuel substitutes; alcohol fuel; ht value of indust'l alcohol. ProfVBLewes. (Soc of Arts Lond.) Prog Age-6|15|08-300-3.5p, 297-0.6p(Ed)

Railway Affairs. (See also 22-24)

- 9 Rules adopted for Indiana Interurban roads. St Ry Jrl-6|27|08-166-10p*, 148-0.7p(Ed)
- 10 Youngstown & Ohio River RR; extension of line from Salem to E Liverpool, O; track & roadway; pr station foundations & equipmt; transmsn line & sub-stations; rolling stock. CWRicker. St Ry Jrl-6|13|08-68-10.4p*+
- 11 Distribution: central station distbtg system; transmsn & conversion; (diagram showing portion of transmsn system in Chicago 1908); sub-stations; converters. HRGear & PkWilliams. El'l age-7|08-144-7p+
- 12 New classification of el'l ry expenses by Interstate Commerce Commn; objection to division of el cos & other points of criticism; depreciation; advantages of modified form over original classification. WHLawton. Journal Accountancy-6|08-114-8p+

Book Accessions.

- 13 Organization, equipmt & operation of the Structural-Materials Testing Laboratories at St. Louis Mo.: methods employed in testing concrete, sand, stone, etc. RichardLHumphrey with preface by JosephAHolmes. U S Geol Surv, Bull No. 329. 84p, 6x9, illus, 1908. *6874.B329
- 14 Tests of concrete & reinforced concrete columns; series of 1907. ArthurNTalbot. Univ of Ill Engrg Experiment Station. Bull No. 20. 59p, 6x9, illus, 1908. *077.T14f
- 15 Results of spirit leveling in Cal 1896 to 1907, inclusive. SSGannett & DHBaldwin. U S Geol Surv, Bull No. 342. 172p, 6x9, 1908. *6874.B342
- 16 Tests of cast-iron & reinforced concrete culvert pipe. ArthurNTalbot. Univ of Ill Egrg Experiment Station. Bull No. 22. 66p, 6x9, illus, 1908. *072.11G
- 17 Water-supply investigations in Alaska, 1906-07; Nome & Kougarok regions, Seward Peninsula; Fairbanks District, Yukon-Tanana region. FredFHenshaw & CCOvert. U S Geol Surv. Water-Supply & Irrigation Paper, No. 218. 156p, 6x9, illus, map, 1908. *WSI No. 218
- 18 Alternating currents, their theory, generation & transformation. AlfredHay. Ed2, 319p, 6x9, illus, 1907. *071.H32
- 19 El'l engr's pocket book: a handbook of useful data for electricians & el'l engrs. HoratioAFoster. Ed5, 1599p, 4x7, illus, 1908. *071.F81.1908 (No. 30-G)
- 20 Thermodynamics of the stm-engine & other ht-engines. CecilHPeabody. Ed5, 533p, 6x9, illus, 1907. *0722.P31
- 21 Geography & geology of a portion of Southwestern Wyoming with special reference to coal & oil. ACVeatch. U S Geol Surv, Professional Paper No. 56. 178p, 9x12, illus, maps, 1907. *6874.P56
- 22 Railroad reorganization: financial readjustments of Balto & Ohio, Erie, Phila & Reading, Southern, Atch Topeka & Santa Fe, Union Pac, No Pac, Rock Island. StuartDaggett. 402p, 6x9, 1908. *.022.D13
- 23 Rept from joint committee of House of Lords & House of Commons on el prs (protective clauses); procdgs of the committee; regarding franchise restrictions as to earth return circuits & provisions as to leakage, induction or similar matters.

- 270p, 8x13, 1893. *7700.0717
- 24 Am st ry investments; including corporate history, financial & operating statistics, list of officers etc of st rys in U S, Canada, West Indies, etc. 15th an vol. 1908. 473p, 10x13, maps, 1908. *6900.022.St8.1908
 - 25 The Canada Year Book, 1906. Second series; statistics of population, agriculture, minerals, manufactures, wages, commerce, public finance, banks, post office, insurance, rys, canals, fisheries, etc. 515p, 6x9, 1907. *7200.02.1906
 - 26 State of Wash: first an rept of the RR Commsn, 6|23|05-12|31|06, together with the commsn law as amended by Legislature of 1907 & the Reciprocal Demurrage Law. 760p, 6x9, 1907. No. 20 in *6100.05.1906.V2
 - 27 New England business directory and gazetteer, No. 23: containing lists of merchants, mfrs & professional men, also courts, state & county officers, insurance cos, banks, expresses, newspapers, academies, st rys, etc. 1908. 2198p, map, 1908. *.093.N42
 - 28 Atlas of Canada. Dept of Interior, Canada. 1906. Maps showing minerals, forests, telephones & telegraphs, canals, sailing routes, climate, boundaries, drainage basins, length of rivers, etc; charts showing pop, agricultural, mining, marine, financ'l & ry statistics. 13x18, 82 plates, nd *7200 061.1906

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Third and Fourth Floors

STONE & WEBSTER MANAGEMENT ASSOCIATION

Fifth, Sixth, Seventh and Eighth Floors

STONE & WEBSTER ENGINEERING CORPORATION

Basement

ELECTRO—CHEMICAL
MECHANICAL AND RESEARCH DEPARTMENT
MAILING DEPARTMENT

State of Rhode Island Department of Transportation

CONSTRUCTION DIVISION

IN THE STATE OF RHODE ISLAND

Department of Transportation

CONSTRUCTION DIVISION

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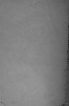
CONSTRUCTION

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STONE & WEBSTER PUBLIC SERVICE JOURNAL

SEPTEMBER 1908

EDITORIAL COMMENT

A very direct question is put by Mr. Rufus Weeks, actuary of the New York Life Insurance Company, in a recent address on "The Most Interesting Phenomenon of the Twentieth Century." The thing he has in mind is socialism. He says: "Even in this country the numerical predominance of the working class grows apace. The successive censuses tell the story in such items as these: The rapidly diminishing ratio of farm owners to the entire population, the decimation and reduction to powerlessness of the small independent business men, the deposition of the male clerk by his sister, and, greatest of all, the enormous increase of the factory population. The coming dominance of the working class even here is as sure as mathematics; in Europe it is already a numerical fact; and twenty years ago I heard James Bryce say that the drastic use of this power is only a matter of a few years, being a corollary of the universal suffrage. The ballot-armed proletariat, awake and aware, will then be able to work out its purpose. The grave question now is: What will that purpose be?"

* * *

After discussing this question at some length, we find him making this assertion: "If in this attempt to read the social mathematics of the times I have read aright, it appears that the working class are to be our masters! Let us hope they will be good to us."

After all they will demand no more of us than the Northern states demanded of the Southern—to come in and be one with them on equal terms. We of the ‘cultured’ and business classes will have to go into the game on the new condition—the condition of being useful to the workers—or else will have to get out of the game. In the latter case we shall, of course, have to get off the ground where the great co-operative machine is working. I see in fancy the bulk of us shipped to some island—clerks, ministers, professors, storekeepers, bankers, lawyers, insurance men, speculators, gentlemen all—and there, without any producers to make a living out of, trying to get salaries or profits out of one another.”

* * *

After all, can the relations of labor and capital be so easily settled? It strikes us that the analogy to the Civil War is not a happy one, in any sense. The factors in the Civil War were of one and the same class. The same identity does not exist in the case of labor and capital; they are two different things, with very different functions. It is labor that does things: it is capital that provides the tools for labor and furnishes the sustenance for labor while it is in process of accomplishing its task. There can never be real equality between things of different classes. The representatives of the classes can be given a political equality, but a political equality is of very little practical significance in such a case. The only thing that will accomplish the end is economic equality, but that seems contrary to nature in the case before us.

* * *

Personally, we doubt very much if the working class, as Mr. Weeks calls it, will ever seriously assume the position he has outlined. The men who man our factories and railroads and other industries are going to get the best living they can out of them. But it is very doubtful if the bulk of these men—which would mean the bulk of the nation—ever become really eager to obliterate the distinction between what, for want of better terms, are commonly called labor and capital. Each has too important a part to be allowed to merge itself in the other. The law of specialization put them asunder at the start, and has kept them asunder until now. Representatives of labor evolve in large numbers into the capitalist class, and by the law of compensation representatives of the capitalist class are frequently absorbed by the labor class. But while individuals change, the classes remain fixed. The one is as useful and as necessary as the other.

What of the Future?

It is safe to say that with most persons the year begins, not on January 1 or July 1, but approximately on September 1. That seems the natural starting point in computing a man's yearly activities. A man, so far as these activities are concerned, is wound up and runs down and is re-wound. September 1 is about the time when, in the case of most of us, the annual winding of the machine is completed. We are then, as we say, prepared to get down to work once more. It is quite obvious why this is the appropriate period for the winding of the clock. In the first place, summer is the time when the human system most feels the need of rest—it is, so far as any period can be, the fallow time in the lives of men and women. If properly employed, it results in a toning up, a reinvigorating of the system. When summer begins a man feels that he is completing a stint of work; when it ends, he feels himself in condition to undertake a new stint. A second reason why September 1 is the most appropriate mile-stone in the life of man is this: it is about then that he is in possession of the materials on which his physical activities for twelve months are based. No matter what his course in life may be, it is governed primarily by seed time and harvest, and it is around September 1 that we begin clearly to see to what extent seed time and harvest have endowed us. Briefly, when the human clock has been rewound and the size of the crops is fairly well determined, then man girds up his loins for a new round in the contest of life.

Such a period has once more been reached, and it is natural that every one should now be calculating the chances for the next twelve months. What is the next year going to bring forth in the way of industrial prosperity? This is the question that is exercising every one of us.

We say now, as we have said before, that it is idle to predict. The factors in the situation are too numerous, too complicated, and many of them are too far hidden from observation, to admit of prophecy. If the only things to be considered were the size of American crops and the abundance of idle money in this country, one could boldly predict a large increase in the nation's industrial activities in the next twelve months. In fact, some who pose as authorities in financial affairs do not hesitate to pursue precisely this course. We may hope they are right without committing ourselves too unreservedly to their conclusions. As yet there has been

no very pronounced departure from that policy of rigid economy which has characterized buyers of every sort in the last year—business still being conducted very largely on the hand-to-mouth principle. Nothing conclusive can, however, be drawn from this fact. It is always possible that circumstances may arise which will cause the abandonment of such a policy with surprising alacrity. But the simple fact is that they have not arisen as yet.

There is, however, if one may take the word of Bradstreet's and Dun's, a gradual lessening of the conservatism of buyers. The former, for example, said on August 22: "While conservatism still rules purchasing, the number of buyers in leading northern and western centers is very large, and there is a distinct gain in the jobbing distribution of fall and winter dry goods, shoes, clothing, hats and millinery. Optimism as to the future is noted, and the practical completion of the small grain harvests, especially of spring wheat, and the advance of the corn crop toward maturity have made for an accentuation of the more confident feeling. Several markets report that while buying is small and frequent rather than individually heavy, the aggregate volume of business doing is the largest for a year past." And Dun's, on the same date, declared: "Trade and industrial activities continue to expand, improvement being of a conservative nature that promises permanency. There is little disposition to anticipate the future, but current distribution is larger, and mercantile collections are more prompt. Jobbing houses are busier, retail buyers providing for known requirements in fall lines, although the orders are of moderate size, precluding the possibility of overstocked shelves."

Summed up, it amounts to about this: everybody seems to want to do business, but nobody wants to be the first to discount the future on an extensive scale. So far as mere feeling goes, the outlook is encouraging. Though the crash of last October was, in some respects, the most remarkable in our history, and though it was followed by as rapid and drastic curtailment of general business as any we have ever known in this country, the spirits of everybody identified with trade and finance are, after nearly twelve months, higher than after other great catastrophes of a similar nature. This may prove much, or it may prove little.

A recent statement in a financial magazine, dealing with a particular aspect of the situation, is of enough interest to be included in these remarks. In Moody's Magazine for August we encounter this editorial declaration:

"As for the prices of high class bond issues, these will continue to be largely influenced by the prevailing interest rate, and as there is naturally at the present time a large amount of capital lying idle in the banks, and drawing but nominal returns, we may, as confidence grows during the coming year, expect to see a further very substantial advance in bond prices until the basis of approximately 4 per cent is reached for the standard issues. It is a logical deduction from these conditions that the year 1909 should be, in the bond investment field, a year of exceptional activity. Probably the bond business will exceed in volume that of any year since 1905, and of course will continue to expand as long as money remains comparatively easy and interest rates do not materially advance. By the end of 1909, however, we should logically begin to see the world's interest rate undergoing a substantial rise until it again reaches the high average of the period anterior to the break of last winter. This tendency for the interest rate to work back to its high level will, we believe, continue to be a normal movement as long as the world's gold production continues to expand at its current marvelous rate. This expansion seems likely to continue for an indefinite period."

The writer of the above certainly has the courage of his convictions. How far he may be right as to dates, we must leave time to determine. Still, what he says with reference to the relation of the bond market to the money market in a period subsequent to a great financial crisis, has had ample justification in the past. One of the striking features of the long depression following the panic of 1893 was the great demand at constantly rising prices for good interest bearing bonds.

A Typical Swindle

We have just been reading, in a clipping from a western paper, a "Review of That Electric Line." The clipping was sent to us by a friend, who writes: "We have heard of one or two such occurrences recently. We happen to know that the general statements contained in this clipping are true." The situation depicted is an interesting one, and, we are afraid, a somewhat typical one. For the latter reason, a narration of the details will not be out of place here.

It seems that a certain man dropped into a western town,

claiming to be the representative and chief engineer of a new interurban railway company, reported to have been organized by Chicago capitalists for the purpose of connecting the town in question with a number of other localities, provided the people of these various localities would subscribe stock equal to what was considered one-fifth of the cost of the line. A proposition was made to the farmers that they should take stock at the rate of \$5 per acre for agricultural land, \$1 per acre for pasture lands, and \$20 for irrigated lands. But for some reason the farmers were cautious. A prominent attorney in that part of the country, acting in behalf of the new company, laid the matter before the people, who were all prepared to give the project their moral support, but who insisted that assurance should be given them of the financial responsibility of the company. Such assurance was promptly given by the attorney in question, who is pronounced to be one of the ablest lawyers of his state. He declared that he knew of his own knowledge that the company was able to carry through anything it saw fit to undertake, and his word appears to have had great weight with his friends and neighbors.

On such introduction the company hired engineers, surveying was begun, and preliminary lines were run to four or five different towns. The western paper from which we are drawing our facts visualizes the situation rather well:

"In due time the first month rolled around and pay day was at hand and every man who had a dollar due him got his money; the second month rolled around and the money was on hand for the payment of bills; the third month rolled around and bills were again paid; the fourth month rolled around and the money did not show up on time, but as the railroads were passing through some heavy floods just about that time, and the trains were laid up a week or more, due allowance was made for the delay, and things went along until the fifth payment was also due, and when the employees began to make it known that they wanted their money." Then the representative of the company found it convenient to leave town, and at last account he had not returned.

There is not much more to tell, beyond the fact that the lawyer of whom we have spoken would afford not the least assistance to the hoodwinked people of the locality in their effort to get at the real facts in the case. He was asked to divulge the names of Chicago people who were alleged to compose the company. This he declined to do, "as it would be a violation of confidence between at-

torney and client." No wonder our western paper can find practically nothing to say but "So there you are!"

There you are indeed—and in a very large sense. For the mischief of this sort of thing greatly exceeds the damage inflicted on the particular people gulled. The whole nation is injured by the prevalence of such practices. When a man has been swindled in the way just described, he is apt to become cynical; and when the country is full of men who have been so swindled, the effect of their cynical attitude on legitimate industry is bound to be very pronounced. An atmosphere is created that is hostile to the proper aims of conservative and public spirited exploiters of the nation's resources and facilities.

Essentially, the scheme which we have described was identical with that of most of the swindles by which the public is robbed. Its salient feature was the use of the name and influence of a man of high standing in the community. There you have perhaps the worst evil in the material life of the nation. It was once said that a good name was rather to be chosen than great riches; today, however, it is comparatively easy to barter a good name for great riches.

MINNEAPOLIS: A FIELD FOR THE LIGHT AND POWER BUSINESS

The most important interest to a public service corporation is the public which it serves. The best equipment in the world, the largest conceivable investment in electric light and power, would lose its significance if it stood in the middle of a desert; it gains its significance by being placed in the midst of great numbers of a particular kind of people. The most important thing about Minneapolis is that it is a metropolitan field wherein are concentrated a vast number of human species. And the greater the concentration, the greater the activity of the mass; the greater the activity of the mass the greater the demand for the harnessing of energy within and the importation of energy from without. It would, then, hardly be worth while to tell of The Minneapolis General Electric Company without telling of Minneapolis.

Every city has a reason for being; the reason for Minneapolis is that the Mississippi River, cutting a continent with its bulky flow, met with a ledge of rock and through the centuries slid over the top and plunged downward at the edge. Explorers called this plunge the Falls of St. Anthony. Minneapolis of all the cities of the land is pre-eminent as a city of water power. Perhaps of all cities of the world it is the one conspicuous example of a metropolis with a hydrostatic soul.

Nature favored this spot still more, however, for it surrounded it with a vast store of timber, mineral wealth and richness of prairie soil. So that with resources all about, and the power to convert raw material to man's uses, roaring over St. Anthony's ledge, a city could grow, and could grow rapidly. The astounding fact about Minneapolis in 1908 is that men live there today who can remember when Minneapolis was not. Sixty years ago there was no Territory of Minnesota; the last governor of the State was born before it was admitted to the Union. So that these are matters for marvel as one sees this vast expanse of stone on stone, and brick on brick, stretching miles wide below the daytime haze of urban activity brilliant at night with winking of city lights.



Small wooden building, possibly a shed or a small house, situated in a field.

But at the time of the war of 1812, there existed on the upper Mississippi river banks only a few log huts, a few dozen of French backwoodsmen engaged in the hazardous business of fur trading. Enthused by the favorable reports of ardent pioneers returning to their native land, rich with the spoils of natural resources of the upper Mississippi river valley, these men established a trading post on the river bank on the east side of the river, within a stone's throw of the present St. Anthony Falls in southern Minnesota.

To the ingenuity of the French under Louis XIV the city of Minneapolis owes the credit of discovery of the St. Anthony Falls, together with that portion of the upper Mississippi River banks upon which this city is now situated. The personal credit, however, must be tendered to Louis Hennepin, a Franciscan priest, who in 1680 joined an expedition under Robert Cavalier de la Salle, for the purpose of seeking gold and glory in the lower Mississippi Valley. Hennepin was assigned the task of exploring the upper Mississippi, and early in August of 1680, set camp near the palisades of the river just below the Falls, which he then named "St. Anthony." Here he met Duluth, who, starting the year previous from Lake Superior, passed the winter among the Indians and in the early spring discovered the St. Croix River, which today through The Minneapolis General Electric Company's Taylor's Falls plant furnishes thousands of horsepower of energy to the factories of the city of Minneapolis.

No further development was made until early in the present century, when the United States government, realizing the value this country afforded, authorized Lieutenant Pike, he of Pike's Peak, to survey and report on the St. Anthony Falls and the outlying district. A most favorable opinion was submitted, in which it was stated that an abundance of valuable wood was found, among which were white oak, hickory, walnut, linden, sugar-tree, white bud and American box. Regarding the possibility of water-power development from the Falls, the report contained the statement that there was a perpendicular fall of sixteen and one-half feet and an available fall of fifty-eight feet in two hundred and sixty rods. This was in 1817, and today under the present conditions, a maximum effective head of forty-eight feet is obtainable. During the time since its discovery, the Falls have receded 1000 feet by the sand undermining the sand rock, which underlies the limestone.

Lieutenant Pike negotiated with the Sioux Indians for the ceding of that portion of the upper Mississippi to include the falls of St. Anthony and to embrace nine miles on each side of the river.

At the close of the Revolutionary war, the Mississippi River marked the boundary line between the sovereignties of Great Britain and Spain, the east side belonging to the State of Virginia, that on the west passing to the French as a part of the territory later called the Louisiana Purchase.

In 1848 the "Territory of Minnesota" was organized, having at that time a population of 4,680 people, of which 3,067 were males. Nine years later Minnesota was admitted to the Union and later, the lands on the east side of the river were surveyed and offered for sale, the main streets were laid out 100 feet wide and others 80 feet wide. This portion of the town was called "St. Anthony." Only a few years later the west side of the river was laid out in a similar manner, and in 1856 the town was incorporated under the name of "Minneapolis." In 1867 the two towns were combined and incorporated as the "City of Minneapolis."

This was the early history of Minneapolis until the time it became a city, and many of the earlier settlers are still living by the side of the river in the old tumble-down huts of fifty years ago. But for others time has wrought a change which has brought to them the reward of numberless pioneer westerners; their homes may be found in those beautiful residential districts of the city today, claiming the luxuries which the leaping forward of a settlement bestows upon its early settlers. Old farm houses and homesteads still stand with huge business blocks and wholesale warehouses looming up at their sides. Again one realizes that it is a city built in a single generation.

Minneapolis, because of its cheap power furnished from the water wheels by harnessing the falls of St. Anthony, became the natural market of Minnesota, and the neighboring states. To be sure Duluth is today the second greatest tonnage shipping center in the world but as Duluth grows—so must Minneapolis; as Duluth is the gateway of Minneapolis, for all imported material, so is Minneapolis the supply-house of Duluth for the products of the Middle West. Train loads of coal come from the collieries at Duluth to supply Minneapolis, and in return loads of lumber, wheat, oats and flour are sent to Duluth to supply the world. Minneapolis will perhaps, however, not always be dependent on



Figure 1. A large, dark, textured rock formation or cave entrance, possibly a natural archway, set against a lighter background.

the railroads from Duluth for shipments of coal and other merchandise: a project is well under way at the present time for the deepening of the Mississippi River at its approach to Minneapolis; locks have already been completed, the government dams for regulating the flow of water are finished, and with the idea in view of furnishing this city with the lowest possible rates for transportation and adequate means to handle its manufactured products, the body of Minneapolis business men will doubtless convince the government of the necessity of immediately taking up the matter of dredging the river to make this city the head of navigation.

But after all Minneapolis is not essentially a distributing centre; it is a manufacturing city; its flour and lumber business are of world-wide fame; and these, together with one hundred and fifty other industries, aggregate a manufactured capital of over seventy-five million dollars. The magnitude of some of these industries is hardly known even by Minneapolis itself. Fifteen million barrels of flour are being turned out annually by the flour mills situated along the banks of the river, which use the great "white coal" to turn their wheels. It is the power of the river which grinds the wheat and conveys it in its various forms on the belt conveyors through the numerous processes to which it is subjected, not having once been touched by human hands from the time the seed is first planted until the time it is sealed in barrels. Then there is an output of twenty-two hundred million feet of lumber, sawed, planed and finished yearly; hundreds of thousands of trees cut yearly are floated down the Mississippi river, guided by log booms to the sluiceways of the St. Anthony's Falls, to enter the mills where they are cut into standard lumber by the same element that formerly nourished them and later floated them down stream. The products which during the past year were manufactured within the city limits, were valued at one hundred and thirty-seven million dollars.

Situated as it is, in the heart of the largest grain producing country in the world, with cheap power and adequate shipping facilities, there is every inducement for the encouragement of manufacturing industries; and that this fact is realized is evidenced by the numerous large factories which are at present under construction. The annual value of manufactured product per capita is \$459.00, which, with but one exception, is the highest in the United States. This is the result of fifty years of unparalleled prosperity, during which time the city's population has increased from two

thousand to more than three hundred thousand. A remarkable development; yet the city is still in its infancy.

Among those mediums which go to make up the rapid growth of an industrial city, are the means of handling its manufactured products; it is only natural that we should look from manufacturing interests to their resultant effects on commerce. Not a single railroad entered the city of Minneapolis at the time of the Civil War. The nearest road was some twenty-five or thirty miles away, a little junction on a branch of one of our present trans-continental lines, a mere flagging station where trains stopped two or three times a week and from which a stage drove to the Twin Cities—Minneapolis and St. Paul. And at times even the stage did not run. But twenty-three railroads now enter this city under the management of ten different systems. In the field of transportation as in the manufacturing industries, it is true that the growth has been rapid, yet nevertheless, has been in the form of a gradual evolution keeping pace with the progress of the community, and has been on a sound and stable basis which cannot easily be shaken by a momentary financial crisis.

Financially Minneapolis is steady. No more striking evidence of this stability of a city can be presented than the effect of the recent panic upon progress and directly upon bank clearings. During the period of general depression, when almost every city in the United States felt materially the effect of the money stringency, Minneapolis, almost alone, felt practically no direct effect, and it is interesting to note that on bank clearings it made an increase during the height of the crisis of 17.5 per cent. In fact this has been a memorable year in the financial history of the city for its vitality reached the billion dollar mark in bank clearings, having transacted \$1,145,466,149 of business, an increase of 15.6 per cent. over 1906. A recent consolidation of two of our largest banks gives to the city one of the largest banking institutions in the West.

Such is the steadfastness in commercial growth of a city built upon a water fall. And yet all the dust of mill and smoke of railroad have not made Minneapolis an ugly city. There is great wealth of natural beauty and a street car system of extraordinary efficiency, connects the more congested districts with a large and growing system of parks and boulevards. In every direction and within easy access are numerous lakes characteristic of the water-dotted map of Minnesota.



Figure 1. The structure of the tent.

With an acquired industrial life of energy and yet a life not removed from the wholesomeness of trees, fresh air and wild and open country, it is in this city, possibly more than any other in the United States that the adventurous active spirit of the pioneer still remains long after the march of conservatism has passed beyond. One would say that Minneapolis was, thus, most typically American.

Before 1898 this city was furnished with power and illumination by competing companies, and it was not until Stone & Webster became interested that this competition actually ceased. The present company managed by this organization represents the consolidation of several companies that at one time occupied the field and it must be said occupied it rather awkwardly. In fact the old situation not only represented an absence of economy, efficiency and business sense but it resulted in furnishing to Minneapolis a poor public service for which high rates were charged. Perhaps good service is the first consideration. Under the old regime the service was bad; under the new it is equal to any in the country. Certainly low rates are the second consideration of the public. Under the old competition the rates were high; under the new, the rates are lower than in most similar fields. Indeed, it is a significant reflection upon the already discarded theory that competition in public service tends to lower rates, that since the Stone & Webster management began, the various rates in the average have been reduced about one-third and this reduction has been voluntary.

Before 1898 the primary lighting rate was 20c. a kilowatt hour; now the primary rate with discounts is considerably less than 14c. and lamp installation is free.

Other changes have taken place, too—new investments, new equipment, new business. In the nine years the value of the plant including the properties of the subsidiary companies which own the water power development on the St. Croix River, has increased nearly threefold. A still greater increase is registered in the gross earnings which were \$284,000 in 1899; in 1907, \$920,000. In the same period of time the city grew 30 per cent. larger.

To meet the extraordinary opportunities for growth of business this company is equipped most efficiently. The Taylor's Falls development made two years ago, at a time when the excess power of St. Anthony's had been all but exhausted, has placed in the hands of The Minneapolis General Electric Company practically all the unused water energy now available to the city. This power

has been partly harnessed and means have been provided to transmit it in the form of electrical energy, forty miles to the machines of Minneapolis manufacturers.

Minneapolis manufactures have grown nearly 40 per cent. in ten years, they constitute 40 per cent. of all the manufactures of Minnesota and the kilowatt output of the company, which carries on both a light and power business, has shown an increase much greater than the increase of its gross earnings. Therein there must be a story of reduced rates and as cheap power can make a city just as St. Anthony's Falls made a city, so then, is the benefit of the new development shared alike by stockholder and consumer, by company and by municipality.

This development is not inconsiderable. Some five million dollars were put into it, some twenty-seven thousand available horsepower were made possible by it; it is one of the largest hydro-electric plants in the United States constructed by a remarkable piece of engineering skill. Taylor's Falls, on the St. Croix River, which furnishes the boundary between Minnesota and Wisconsin and drains six thousand square miles of territory, is a forty mile flight from Minneapolis. Here where high trap rock banks and a possible fifty-five feet head of water was offered, it was determined to build the present dam. For eleven miles above, a primary storage lake was possible and today this storage covers a large territory of flowage land involving a great area of riparian rights. The subsidiary companies of The Minneapolis General Electric Company own all these lands. And at the end of the eleven miles is the old Nevers Dam holding another ten-mile stretch of restrained water. The big concrete dam at the Falls is nearly a half mile long, is over fifty feet high and stands upon a base about forty feet thick. On the Minnesota side of this dam is the log sluice; on the Wisconsin side the power house.

Built of reinforced concrete upon a foundation blasted out of solid trap rock, the power house is today fitted for over 12,000 horsepower utilization, and stands ready to take care of more than double that amount of energy.

A description of the equipment of this station, adequate for the purpose of the present article, was given in a former description of the company's plant and is here briefly reprinted.

"At the upper end of the power house is a drift boom, which guides the ice and debris into a steel bear trap, and which extends across the lake for several hundred feet to a high wall of trap



rock. For the purpose of preventing small pieces of drift-wood from entering the penstocks, a small rack is built against the power house fall with a sluice at one end which carries all such material over the dam.

"To comply with a state law it was necessary to build a fish-way at one end of the station to allow the fish to pass up and down the stream.

"The power house, which is located at the lower end of the dam, where it was necessary to blast away the trap rock headlands, is built entirely of re-inforced concrete, requiring 400,000 sacks of Portland cement and numerous 5-8 steel tie rods (spaced 3 feet apart) with iron rails for reinforcement.

"For each of the four main units a 14-foot penstock feeds two pairs of 36-inch water wheels, rated at 4200 H. P. These run at 277 R. P. M. under full head, and with sufficient capacity at the minimum head of 48 feet to operate the generators efficiently. The two exciter units are fed by four-foot penstocks. The wheel pits are accessible at all times, and for the purposes of removing broken parts a traveling crane with an electric hoist is located over the wheel casings. There is also a 25-ton electrically driven crane in the generator room. The speed of the wheel units is controlled by Lombard governors.

"At present time there are four 2500 Kw. Westinghouse, 60 cycle, three-phase generators, operating at 2300 volts, with an overload capacity of 25 per cent. for two hours. The ultimate development of this plant is 20,000 kilowatts.

"The generator output is stepped up by water-cooled transformers (each in a fire-proof compartment) from 2300 to 50,000 volts for transmission to Minneapolis, forty miles distant over a three-phase system on a pole line with a sixty-foot right of way to the city limits, where it is stepped down to 13,800 volts for transmission to Main street station. From here power is distributed throughout the city.

"The transmission line is 4-0 copper cable, on petticoated porcelain insulators, and required over one-half million pounds of copper. This cable has a tremendous tensile strength to withstand the weight of snow on one portion of the right of way, known as the storm belt. With the exception of a few steel towers for the purpose of crossing the rivers and lakes, the pole line of extra heavy Idaho cedar poles, are 50 feet long and set about 125 feet apart."

Until the development at Taylor's Falls the entire generating system of this company was within the city limits of Minneapolis. This slightly older equipment is not, however, retired by the new; on the contrary it represents a very efficient plant in itself. To quote once more:

"Situated on the east bank of the Mississippi River at the St. Anthony's Falls just across the river from the business district of the city, is what is known as the Main Street generating station. This station is equipped with a 1500 Kw. Curtis steam turbine generator, three reciprocating engines with a total capacity of 3100 H. P., a 1000 Kw. direct connected engine driven unit and three water wheels with a total of 2400 H. P., with a maximum head of water of 48 feet and a minimum of 44 feet. These wheels develop over seven million (7,000,000) kilowatt hours yearly, or about 30 per cent. of current generated at this station. Until December, 1907, this station carried the full load of the city.

"In addition to these the company has two sub-stations, one at the office of the company, 15-17 South Fifth Street, with a steam plant of two units, with a total generating capacity of six hundred (600) kilowatts for a period of one hour. Here also are eight rotaries, having a total capacity of 3050 Kw., which receive part of alternating current generated at Main Street station and part of that received through sub-station "A" from St. Croix Falls, and distributed it underground to the business districts of the city by the Edison three-wire system, which with all other underground equipment represents a value of nearly one million dollars. The other sub-station known as Sub "A" is at the end of the St. Croix transmission line at the city limits. This station contains nine step-down transformers with a total capacity of 9000 kilowatts."

With its water properties and equipment and with a management as carefully organized for economy of men and effort as that of any lighting and power company can well be, with a population of over 300,000 to serve today, which at the present rate of increase will be much over 450,000 in another decade and with a past record of an increase of gross of over 200 per cent. in the nine years during which Stone & Webster have guided its affairs, this metropolitan service corporation could not well fail to meet the vast opportunities that lie before it. After all, the two necessities to such an industry are power to make electrical energy and a population to consume it when made. The Minneapolis General Electric Company now has the power and it has a people to serve



that grow constantly in numbers and who every year evidence a new openness of mind toward the multiplying uses for electrical energy.

For supplying power the future opportunity is obvious. Minneapolis has exhausted its natural local power and fuel is somewhat higher in price than the average throughout the country. Yet with a chance to procure the benefits of energy imported by electric transmission from such power sites as Taylor's Falls there is every reason to look forward to a most wholesome growth of manufactures. The facilities for bringing in raw material and sending out product are furnished by the extraordinary web of railroads formed by those many lines which meet in the city. Every day, too, the West becomes more and more populated. Actual consumption of manufactures comes nearer, and standing in the middle of the continent within reach of the Lakes and at the head of the Mississippi's still undeveloped commerce, this city is already proving an attractive site to industries that have already established plants farther East. Exactly as the retailer moves up Fifth Avenue or Broadway with the change of the retail centre of New York so does the wholesale house and the manufacturer seek the centre of the country as the vitality of commerce moves Westward.

On the other hand in a city where people are prosperous enough to own their homes and progressive enough to want all the advantages that science can bring to their doors, the outlook for the sale of electric lighting is equally apparent. To the benefit of these residence customers, because low rates must follow the high load factor of down town business, and still more, to the benefit of the operating company, is the rapidly extending consumption of electric lighting in stores, factories, places of amusement and offices. Fortunately for both parties to public service the larger the field the greater the tendency toward lower rates; and with lowering rates the business of the company extends. It is indisputable that the wisest policy of an electric light and power company must be toward extension of business which follows cheaper rates and in turn will be followed by them. In Minneapolis as in all places where the field of business is not exhausted rates will be regulated by this sound business policy and by this immutable rule of the industry, even more surely than by any regulation proceeding, wisely enough, from the city itself.

The suggestion offered by mention of the city acts as a reminder of the opportunities in the field of street lighting. Minneapolis has many less electric street arc lamps per capita than most

growing cities and by reason of its ever widening area and its ever multiplying number of parks and boulevards, it needs even more lamps than a municipality which crowds its people into closer confines. But aside from the street lighting purchased at reducing rates by the city itself which must, for the reasons given, amount to more and more each year, there is already in Minneapolis an awakening desire to make the business streets attractive. Following this agitation there has already appeared a plan to place ornamental electric lights all along the thoroughfares of retail trade; today the company has already begun to furnish current for the first long line of business avenue that has installed these lights. The opportunity for supplying the entire down-town district in this way is not remote and adds one more opening for a company which has before it the vast field for development offered by a great metropolitan situation.

DEVELOPMENT OF INTERURBAN RAILWAYS IN THE CENTRAL WEST

By L. H. PARKER.*

The development of electric traction on city and interurban railways in this country during the past 20 years has been nothing short of marvelous.

It was in 1888 that the first successful electric city railway system was inaugurated; viz., that at Richmond, Va. In 1898 the first multiple unit elevated railway trains were contracted for by the South Side Elevated Road of Chicago. This latter system is now in general use in this country and abroad on interurban, subway and elevated electric railways. From 1892 to 1895 alternating current transforming apparatus and high voltage transmission systems were rapidly developed. This made possible the introduction of the interurban electric railway, for it was a comparatively simple matter then to transmit large amounts of power economically from one central power station to substations located as much as 40 to 50 miles away. Since that time the art of high tension transmission has steadily developed, until today we have voltages as high as 112,000 volts, and power is thereby transmitted for distances up to 200 miles.

The interurban railways in the United States, especially in Indiana, Ohio and Illinois, where they have been developed most generally, parallel the steam railroads. It was expected at first that the steam roads would suffer greatly from competition with the interurbans for the short haul business. The result has been that the steam roads have managed to hold their own, on account of the increase of long haul travel which was stimulated by the advent of the electric interurban roads simultaneously with the increase of the short haul business. The interurbans have taken practically the greater part of the short haul traffic, although, for distances over 100 miles, in certain localities, they are making a

*Of the Stone & Webster Engineering Corporation.

strong bid for through business, as will be shown further on in this article.

About eleven years ago the first electric road in the State of Indiana began operations, which was about the same time that interurbans started in Ohio. At the present time there are between 4000 and 5000 miles of interurban railways already built and projected in these two states alone. In Michigan and in Illinois, also, there has been a wonderful growth of interurban railways. It is estimated that in Indiana alone there are about fourteen principal corporations controlling interurban railways, having a total capitalization of nearly \$50,000,000 in stocks and \$50,000,000 in bonds, or slightly more than \$80,000 per mile capitalization. The money invested in interurban railways in this country runs into the hundreds of millions of dollars.

We are all more or less familiar with the development of electric traction in the Central States, particularly Ohio and Indiana. Indianapolis can point with pride to the fifteen electric railways which center at its million dollar terminal station, and which operate about 500 cars in and out of Indianapolis during every 24 hours. At present over 5,000,000 passengers per annum are handled at the Indianapolis interurban terminal. It has been estimated that Indianapolis has increased in population from about 178,000 to 240,000 during the period in which the electric interurban railways radiating from it have been in operation. The same is more or less true of the interurban centers of Ohio, Michigan and Illinois.

It is not over forty years ago that the steam railroads consisted of a number of small roads which have gradually developed into our enormous trunk lines and trans-continental systems. The interurban electric roads today are in process of a like evolution. The Illinois Traction System is now extensively and effectually advertising "limited" and "sleeper" accommodations between East St. Louis and Danville; that is, from the western to the eastern boundary to the State of Illinois, a distance of about 223 miles. The Shoe and Leather Gazette of Illinois states in a recent issue that the "Illinois Traction System has been the means of overcoming a condition which has long been a detriment to St. Louis manufacturers. Freight to points east and north of St. Louis over steam roads required from five days to two weeks for delivery, while Chicago made it a point to deliver these goods in one to two days. The Traction System has proved to be of inestimable value to the

manufacturer in St. Louis and retailers over territory covered by the Traction System. Shoes ordered in St. Louis today are delivered the following day. The dealer readily grasps this opportunity to buy in a market as important as St. Louis, and with the millions of dollars' worth of shoes ready to ship he sees the advantage of a small stock frequently sized up.

"To ascertain the effect upon the towns the Gazette made a canvas of portions of the territory. Without exception the dealers were well pleased and were enthusiastic in their statements regarding the benefits they had received. This, of course, was expected in the larger towns, which naturally profit from the patronage of their smaller neighbors; but, strange to say, the smaller town has been improved in about the same proportions. The Illinois Traction System has acted as a spur to all of its 86 towns and the long stretches of country between. The people have become educated to buy more, see more, desire more and demand more both of necessities and luxuries. In fact what were formerly considered luxuries are now necessities, and the demand for merchandise has increased to a wonderful extent."

Freight and express business has been a more recent, but a gradual development. Many of the interurban roads are handling a considerable business in stone, live-stock, coal and grain. Many electric interurban railways have working agreements with the regular express companies, such as the Adams Express and others, similar to those in force with the steam roads; but wherever freight and express business has been developed the farmer has been greatly benefited. Butter, milk, produce, vegetables and fruit are shipped direct from the farm to the centers of the cities at comparatively small expense. The price and value of the farms have generally doubled within five years after the building of the electric roads contiguous to them. It has also been truly said that the interurban railways improve the attractiveness of the farm. When the attractions in the towns and cities, such as churches, theatres, lecture courses, and the like, can be conveniently attended by the farming people, existence on the farm is quite a different matter. It is believed that the interurban to a large extent assists the farmer in securing a good quality of help. Men will go out to work on a farm if they can get into the centers when they care to. This condition is of considerable importance, as there will be fewer idlers in the city, because the work and the man are brought nearer together.

Some interesting facts concerning long distance travel on interurban roads were recently published in the "Electric Traction Weekly" and other papers. First, as to the longest hauls on various systems. There is one run of 160 miles from Dayton to Toledo, one of 120 miles from Cleveland to Toledo, from Fort Wayne to Indianapolis, 137 miles; from East St. Louis to Danville, 223 miles; from Zanesville to Indianapolis, 250 miles; Indianapolis to Louisville, 117 miles; Worcester to Norwalk, Ohio, 104 miles; Saratoga to Gloversville, N. Y., 75 miles; Chicago to Rockford, Ill., 93 miles.

The Western Ohio Railway Co. runs seven limited trains each way between Dayton and Toledo. There are four limited trains each way between Indianapolis and Fort Wayne; East St. Louis to Springfield, eight limited each way; Cleveland to Toledo, seven; Indianapolis to Louisville, four limited each way; Gloversville to Schenectady, 15 each way.

On the Fort Wayne-Indianapolis trains 15 per cent. of the total business is through traffic. On the East St. Louis-Springfield limited one-third of the travel is through traffic.

At the present there are about 35 through passengers carried daily each way between Indianapolis and Fort Wayne.

The Fort Wayne and Wabash Valley Traction Co. reports that its through business on electric lines has increased largely since 2c. fare laws went into effect, and the Illinois Traction System reports a good increase due to the same cause. This is because the steam railroads have stopped selling excursion tickets at reduced rates. Various other roads in Ohio report an increase in receipts from through business due to the 2c. fare laws. The Fort Wayne & Wabash Valley Traction Co. reports that it pays to run high speed trains on interurban roads and attempt to compete with steam for business for distances over 100 miles. The Illinois Traction System has found this to be true also, as have the Western Ohio Railway Co. and the Toledo Urban & Interurban Railway Co. Most of these roads believe that the maximum distance over which electrics can get business from steam roads varies from 200 to 300 miles. The roads above mentioned report that they are getting considerable business through their inter-line connections with other interurban roads. The Fort Wayne & Wabash Valley Traction Co. is selling tickets from Logansport to Cincinnati, a distance of 273 miles. The Illinois Traction System sells tickets for 225 miles, the Toledo Urban & Interurban Railway Co. and

the Western Ohio Railway Co. sell tickets for distances of about 300 miles. The traction companies above mentioned look for considerable through business when the lines are properly connected up between Indianapolis and Toledo, St. Louis and Chicago, Cleveland and Columbus, Toledo and Cincinnati, and Detroit and Cincinnati. These traction systems are endeavoring to induce the long haul travel by making quicker time, stopping at county seats only, and making a record for keeping their limited trains on time all the time. All of the systems are advertising extensively and giving good service, which is, of course, the best advertisement. The traction systems have found that chair seats for long hauls have a tendency to increase the business; but there is a difference of opinion among the various systems as to whether extra fare should be charged or not for chair seats.

The Fort Wayne & Wabash Valley Traction Co. has found that the buffet service has proved profitable for long travel. The Illinois Traction System has found it an inducement to travel, but it does not pay expenses. The Toledo Urban and Interurban report that the buffet service does not warrant the expense.

The Illinois Traction System believes that the prospects are good between large cities eight or ten hours apart for sleeping car service. They are operating such cars at present, but the distance is hardly great enough, and one of the terminal cities is hardly large enough. They state, however, that such cars are good advertisement. Other traction companies in Ohio and Indiana are inclined to believe that there is not sufficient demand at present for sleeping car service on the interurban systems.

Contrasting the transportation facilities between the various cities and towns of the State of Indiana as they exist today with what they were formerly, we have: First, the run from Indianapolis to Anderson, 39 miles; in 1899 there were six steam trains per day and the fare was \$1.10; at present there are nine steam trains, but 0 electric trains having a fare for the latter of only 60c. The run from Indianapolis to Wabash, 90 miles; in 1899 there were only three steam trains and the fare was \$2.07, today there are about three steam trains and about 14 electric trains having a fare of \$1.40. From Indianapolis to Logansport, a run of 77 miles; in 1899 there were two steam trains with a fare of \$2.30, today there are three steam trains, but 12 electric trains having a fare of \$1.25. The same contrast may be made as to the runs between Indianapolis and Muncie, Union City and Crawford-

ville, Lafayette, Columbus, Richmond and others. It is seen that the traction lines have not only doubled, trebled and quadrupled the train service, but have cut down the fares on an average of about 50 per cent.

In connection with this subject of the development of interurban railways it may be of interest to discuss briefly the question of how to determine the feasibility of any interurban project. Of course, the original idea is conceived by the promoter. He, however, soon recognizes the necessity of procuring competent engineers to determine technicalities. The engineers first make a careful study of the probable gross income of the proposed road, for that is the thing of prime importance to the banker or financier who has been asked to put his money into the scheme. The amount of the gross receipts determine, more than any other one factor, whether the proposed road will be a success or not. While for a city road it is comparatively easy to determine what the number of rides per inhabitant per annum would be, as elaborate statistics have been obtained on this class of transportation, the predetermination of passenger earnings per capita for an interurban road is a much more difficult matter.

The first difficulty is as regards the terminal cities. Generally, interurban roads have one large community at one end of their line, which fact has an important bearing on the amount of business to be done by the road. It has been found that it is not proper to consider the entire population of the terminal community as being served by the interurban railway. In figuring the population served by the interurban road it is generally the practice to include all the population within two or two and one-half miles of the line on either side, and a certain per cent. of the terminal city population should be added to this. The next step is to determine what would be the average receipts per inhabitant served per annum. Statistics show that for the interurban electric railways centering in Cleveland, Ohio, for the fiscal year ending during the year 1905 the average passenger earnings per mile were \$4,310. Passenger earnings per inhabitant, including the population of the terminals, were 91 cents. Passenger earnings per inhabitant exclusive of terminal population were \$14.20. The total earnings per mile of track averaged \$5,045. Similarly for the group of railways centering in Columbus, Ohio, for the same period. The passenger earnings per inhabitant, exclusive of terminal population, averaged \$11.46, and the passenger earnings per mile of track

averaged \$3,202 while the total earnings amounted to \$3,829. In all Ohio for that year there were only four roads having passenger earnings exceeding \$5,000 per mile of track. On the other hand, there were only four roads out of the 28 which had passenger earnings of less than \$2,000 per mile of track. For the same period, considering total earnings, both freight and passenger, the interurban railways of Ohio earned, gross, between \$2,500 and \$5,000 per mile of track, and the greater portion of them showed gross earnings of about \$3,500 per mile. These figures, however, held true only up to last fall. The recent financial and commercial depression has generally affected the receipts of railways, both steam and electric, during the past ten months, particularly in manufacturing communities. That is, many roads show a decrease in gross receipts. There are, however, a number of electric roads which show an increase in both net and gross receipts for this period.

As to the cost of a first-class interurban road, this will depend largely upon local conditions, the character of service and the system to be adopted. It may be anywhere from \$20,000 to \$40,000 per mile of single track. Up to a year or two ago most of the interurban electric roads in this country had adopted the 600-volt direct current system of electric equipment. About two years ago the single-phase alternating current railway motor was developed, by means of which the first cost of the electric transmission and distribution lines is considerably decreased from that of the 600-volt direct current system. The alternating current systems, however, were obliged to operate their cars over the large terminal city streets and through the smaller cities en route, where the standard direct current systems were already installed; consequently the electric equipments of the cars had to be such that they could be operated on both the direct current and alternating current trolley lines. As a result, the equipments were more expensive, more complicated and, consequently, less reliable than the 600-volt direct current equipments. There are today, however, about 1000 miles of single-phase alternating current interurban roads and electrified steam lines in this country, either built or under process of construction. Within the last 18 months one of the larger manufacturing companies has so developed the direct current motor that it can be operated with considerable success with 1200 volts on the trolley wire. It is possible, therefore, to effect a considerable saving in sub-station equipment and the amount of copper feeders

required. This recent development of the 1200-volt direct current system has been welcomed by those interested in the transportation business. This system has a considerable field, for it comes between the 600 V. D. C. and the single-phase alternating current systems having high voltage A. C. on the trolley. The motor equipments for the 1200-volt system operate with equal simplicity and reliability on either 600 or 1200-volt trolley current.

Much might be written regarding the relative advantages of the different systems; single-phase A. C., 1200-volt D. C., and 600-volt D. C.; but it is sufficient to state here, that for any electrification proposition, the system to be adopted will depend upon the local conditions to a large extent. The principal determining factors are the weight of trains, schedule speeds, number of stops, frequency of the trains, the profile and alignment of the line, location of power supply with relation to the line, the cost of building materials, electrical and steam machinery, of copper wire, coal and labor. It is evident, therefore, that each proposition must be figured out carefully by itself.

CHANGES IN THE LABOR SITUATION IN SEATTLE

By J. W. McCLOY.

The financial depression which marked the closing months of 1907 concluded what was probably the most remarkable era in the history of the country. Ten years of continued prosperity, during which the American people grew increasingly extravagant and careless, brought the nation face to face with the gravest of all dangers, indifference, the spirit of which seemed to pervade all classes of society.

In Seattle, this period was remarkable in many ways. Following the expenditure of nearly \$15,000,000 for terminal facilities by the Chicago, Milwaukee & St. Paul and Southern Pacific railways, came a rise in property values and an unparalleled era of real estate speculation. All classes participated; in the year ending March, 1907, over \$100,000,000 worth of property changed hands. Clerks, mechanics and professional men of moderate means became wealthy over night. The cafes and places of amusement were crowded with these "tide-land millionaires," while their automobiles endangered the lives of their less fortunate neighbors on the crowded streets.

With this sudden prosperity and the attendant increase in building and industrial operations, came a scarcity of labor, and to meet it, an increase in wages in nearly every department of activity. Never was the workingman more independent, more regardless of consequences or more indifferent—a condition which the increased wages seemed to aggravate rather than remedy.

The resulting demoralization was not slow in making itself felt in the ranks of the street railway employees, where the same spirit of unrest which characterized other classes of workingmen became evident. Men who had been years in the service left to open real estate offices or accept other employment, and great diffi-

culty was experienced in selecting suitable employees from the few who applied for work.

An advance in wages was decided upon and became effective April 1st, 1907, when a sliding scale amounting to an increase of approximately 12 1-2 per cent. was put into force.

Gripmen on the cable lines were paid 1c. per hour more than conductors and motormen. It was hoped this substantial advance would have a tendency to check the current of unrest, but this was true only in part. Men continued to leave the service for one reason or another, and by the middle of summer, with traffic the heaviest on record, over 60 per cent. of the trainmen had been in the service less than one year. The older men appreciated the increase wages and for the most part continued to perform their duties with the usual satisfaction, but the indifference and carelessness displayed by many of the new men brought despair to those responsible for the safe and proper operation of the cars.

An extraordinary number of more or less serious accidents resulted, and the summary discharge of the careless trainmen seemed to have little or no moral effect on the others.

Despite the fact that competent men were scarce and it was a frequent occurrence for cars to be left in the house during heavy travel for lack of crews to run them, measures to ensure discipline were not relaxed for an instant. Discharges and suspensions were daily occurrences, and this, together with the large number of voluntary resignations, taxed the resources of the employment and instruction department in its efforts to keep the list full.

Perhaps the most aggravating difficulty was with the student trainmen. Every effort was made to attract and retain desirable applicants, to facilitate their breaking in and to interest them in the work, but there were many cases where an applicant would be accepted, spend ten or twelve days breaking in, buy a uniform and be put to work, only to leave after several weeks in the service, making a dead loss to the company of the time and care spent in his instruction.

During the month of July, 1907, for example, although 169 men were employed by the instruction department 156 trainmen left the service for one reason or another. Discharges formed a large per cent. of this number, as they did, in fact, during the entire summer. During the six months ending with September, of the 745 men leaving the service 396 were discharged for cause or resigned while under suspension, and of the 1500 men who passed

through the instruction department in 1907, only 1088 remained long enough to qualify, and of this number less than 400 are in the service at the present time (June, 1908).

But "It is an ill wind that blows nobody good." The "panic" of recent memory has proved a blessing in disguise and effected great changes in the conditions above referred to. The evil of indifference has passed on—forever, let us hope—and better results are to be expected. Although in many classes of employment the wages, which were raised during the flush times, have been reduced to a more normal figure, the scale adopted by The Seattle Electric Company remains unchanged, a fact which the trainmen are not slow to appreciate.

More and better men are applying for work in the train service, and the employment department is enabled to use more discrimination in making its selection than was possible a year ago. The trainmen are contented, and more careful, accidents have decreased, and the standard of discipline is higher than ever before.

Let us hope that the next wave of prosperity will find the American people qualified to enjoy its blessings without going to dangerous limits of extravagance, as they have done in the past.

THE RIO GRANDE RECLAMATION PROJECT

By C. W. KELLOGG, Jr.

The traveler from the East who approaches El Paso over any of the transcontinental lines which pass through that city is always impressed with the vast desert which extends for hundreds of miles in all directions around West Texas and New Mexico. If he is accustomed to judging the prosperity of the country by the abundance of green fields and farm land, he draws the conclusion that the land is extremely poor and that nothing but cactus and sage can grow in it. The presence of cactus and sage is, however, fully explained by these two figures:

Annual rainfall, 9.84 inches.

Annual evaporation, 84.6 inches.

That is, the lacking factor is water. The soil of the Rio Grande valley is extremely rich and fertile, and the record for the highest percentage of sunshine in the United States, taken together with the richness of the soil, makes, when irrigation is furnished, such wonderful results, for example, as five or six cuts of alfalfa per year.

Three hundred years ago this valley was explored and settled by the Spaniards, who found the Pueblo Indians doing a flourishing agricultural business by means of irrigation. This the Spaniards were not slow to imitate. The "acequia madre" or main ditch on the Mexican side of the river at El Paso is referred to in the archives of the City of Juarez (then called "Paso del Norte") as far back as 1600. It appears that at that time about 40,000 acres were under cultivation in the El Paso Valley, mostly on the Mexican side.

With the settlement of Colorado, the waters of the Rio Grande were diverted for irrigation in that state to a total amount of 200,000 acre feet per annum. This caused a serious shortage of water in the vicinity of El Paso and also raised an international question between the United States and Mexico, the latter country claiming that they had a prior claim to the waters of the Rio Grande which had been taken from them by the irrigation in Colorado.



Figure 1. A black and white photograph of a landscape, possibly a field or a body of water, with a dark, silhouetted structure or hill in the foreground.

The Rio Grande at El Paso is a storm water stream receiving hardly any supply from permanent springs and hence subject to enormous variations in its flow. During the past ten years the average discharge in cubic feet per second for a whole month has varied from 0 to 14,300. The following scheme has been devised and started into execution: The United States Reclamation Service has been studying the flow of the Rio Grande for over ten years and has found that by the construction of a dam at Engle, New Mexico, about 90 miles north of El Paso, a reservoir can be created which will be capable of furnishing the El Paso valley with 600,000 acre feet of water per annum for the irrigation of 180,000 acres of land. Of this amount it has been arranged by treaty that 100,000 acre feet per year shall be delivered to the Republic of Mexico at the Diversion Dam at El Paso. The cost of this project will be about \$7,000,000, and the manner of financing it is very interesting. The United States Government has by appropriation from year to year created the so-called Reservation Fund. The money contained in this fund is used for paying for the first cost of such irrigation or reclamation projects in various parts of the country as this one on the Rio Grande. No work is started, however, until the parties who own the land to be benefited by the irrigation scheme have organized themselves and agreed to pay back to the government the entire cost of the project. In the case of El Paso, the El Paso Valley Water Users' Association has been formed. This association has agreed with the Reclamation Service that a charge of \$1.00 per acre per year shall be paid for the lands covered by the Irrigation Scheme for a period of forty years, this charge to be a lien upon the property. This makes a total of \$7,200,000 at the end of forty years for the 180,000 acres to be irrigated, the government standing any loss due to accrued interest which the transaction might involve.

Several interesting studies have been necessary on the part of the Reclamation Service in the working out of this scheme, especially of the effect of evaporation and the deposit of silt in the reservoir. For instance, it has been figured from observations extending over a period of nearly eight years that out of the 6,075,000 acre feet of water flowing into the reservoir 109,500 will be deposited as silt and 1,089,000 lost by evaporation, leaving 4,624,000 available for irrigation, or about 600,000 acre feet per year. That is, the losses by deposit of silt and evaporation will amount to about 25 per cent. Another interesting problem is that

regarding the effect on the usefulness of the reservoir after silt has gone on accumulating for a long period of years. The government engineers have figured that at the end of eighty-two years the reservoir will be 60 per cent. full of mud, unless some scheme is devised to get rid of it. This mud in the reservoir at the end of eighty-two years would have a maximum depth of 150 feet and its surface would cover 25,516 acres, its dimensions being 11-3 miles wide and 30 miles long. The entire water space above this mud would have a maximum depth of only 25 feet and a surface of 38,000 acres. Various sluicing schemes are now being devised for the washing out of this mud during years when the quantity of water in the reservoir has fallen to a low point.

More or less active work has been started on the construction of the dam at Engle, New Mexico, known as the Elephant Butte Dam, on account of the headland of that name which forms the support of one end of the huge dam, but it is not expected to have the work completed for about six years.

The following brief statistics will convey a clearer idea than words of the physical magnitude of this scheme:

Storage capacity of reservoir, 2,000,000 acre feet.

Height of dam from bedrock to crest, 255 feet.

Height of dam from riverbed to crest, 190 feet.

Thickness of dam at bottom, 180 feet.

Thickness of dam at crest, 20 feet.

Length of dam at crest, 1150 feet.

Length of reservoir, 40 miles.

Length of spillway, 800 feet.

Height of spillway below crest, 15 feet.

The real meaning of this great irrigation project to El Paso and the surrounding country can be obtained only from a glance at the results in a productive way. With irrigation to be furnished by the Elephant Butte Reservoir each of the 180,000 acres irrigated will produce an annual gross yield of at least \$60 to \$80, or from \$11,000,000 to \$14,500,000. In special cases a much larger return can be made. Well irrigated land is worth \$250 per acre, so that this project will create new values of about \$45,000,000. The enterprise of this country has in the past been described as making two blades of grass grow where one grew before. The Rio Grande irrigation project will produce many millions of value where none existed before.



A PONCE "UNIT"

By WALTER H. BALCKE.*

The Ponce power station has a "unit" the like of which perhaps no other of the companies can exhibit. A Ball & Wood Corliss engine of 350 H. P. was recently sent to us from Key West to fill a vacant space left by an accident last year. We call it the "new engine," and it will indeed be this when a few more repairs have been made. Two 230 volt D. C. generators formed part of the legacy of the old Spanish lighting company which preceded us, and as these would otherwise be useless they have been connected in series and their voltage raised sufficiently to operate the railway. The belts pass directly from two engine fly-wheels, and upon one of them is superimposed a larger belt which operates a rather elderly Westinghouse revolving armature alternator. This alternator has been rewound to furnish 2200 volts instead of the originally intended 1100 volts. As no inscription tells how many lamps the alternator should illuminate, we expect the belt to do the necessary complaining. It does.

Thus the entire A. C. and railway loads during the day are carried by one engine. As we have but three cars operating regularly on the D. C. machines, the load varies extremely rapidly between zero and full load and, the governor not being of a sensitive type, the engine and alternator speeds act accordingly. The public not caring to be informed that a car has started or stopped somewhere on the line, this engine was not used at night. Such use would increase the station economy greatly, since it would allow two well loaded engines to be run in the place of three carrying lighter loads, and so an attempt was made to "regulate" the A. C. voltage.

The regulation of the alternator itself is very poor with change of load, and its field current must be altered through very

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wide limits, especially when the power-factor is low. At full load about 160 volts were required on the field, and this was more than the small exciter could safely be made to furnish. This caused us to divide the ten field coils into two parallel parts and to operate the exciter at 80 volts with double current. A regulator was made, largely of arc lamp parts, to keep the A. C. voltage constant by rapidly short-circuiting and opening the exciter field rheostat. This would take care of very sudden changes in speed, as the inductance of the field coils in parallel was very low and the exciter field was worked on a sensitive part of the saturation curve. It was soon evident, however, that with high armature current and weak field the exciter sparked badly, due to the great effect of armature reaction. The field coils of the alternator were then returned to series and current for them was taken from one of the railway generators at 260 volts, the exciter being in the circuit as a negative booster to cut the voltage down to the required 160 volts and to return the surplus power through its belt. It was expected that when the speed suddenly fell the negative booster could be made to lower its voltage more than the railway generator, and thus raise the alternator field current sufficiently to compensate for the drop in speed. This method was abandoned before any very fine adjustment had been reached, as it was not considered wise to have the exciter circuit depend for its current upon the action of grounded railway generators, and also on account of possible danger to the exciter in case its belt should break.

As the exciter did not furnish sufficiently high voltage to allow the alternator field coils to be connected in series, and as it would not commutate well while furnishing double current at low voltage to the field in two parallel parts, it was calculated that between these two methods of connection another could be found which would give proper results. This was true when five of the coils were connected in series with two groups, of three each, in series-parallel. There was a winding on the field, which originally carried a compensating current from a rectifier on the end of the shaft, and this was connected in as the eleventh coil. This method of connection was satisfactory for both the alternator and the exciter, and is now in use. The coils were selected so as to give a magnetic balance, and the only adverse effect is that the heating is not evenly distributed. This is not serious.

To secure compensation for the changes in speed the railway current has been sent through a low resistance on the grounded side



Figure 1. A dark, textured, rectangular object, possibly a book cover or a piece of fabric, set against a light background.

of the circuit, and the series field of the exciter is connected as a shunt across this resistance. Thus when the railway current increases it assists the field of the exciter sufficiently to compensate for the drop in engine speed. The inductance of the exciter and alternator fields affects the current properly to take care of the fact that the engine speed does not change instantaneously with a change in the railway load. Fine adjustment for regulation is obtained by use of the exciter shunt field rheostat so as to place the field of the exciter in the position of proper sensitiveness on the saturation curve.

The alternator is now used at night, and even the opening of the railway circuit-breakers can be only slightly noticed in the light. We should state that these operations did not occasion any suspension of business on the part of the company.

A NEW PAPER ON LIGHTING PHENOMENA

We believe the following copy of letter received by us after a heavy thunderstorm is worthy of a place among the many masterful papers which have appeared this year in various technical publications touching the subject of lightning phenomena.

June 12th, '08.

Electric Co.,
City.

Gents!

We call your kind attention to the fact that *every time* as a bad weather comes—lightning striking somewhere wires—every time the pole out door our factory is stricken, the transmission appears out of order and a dangerous event may happen some day. So just now 9¼ o'clock, a flame about 5 yards big sprung from the switch—offer a detonation and big flame on the pole—sprung into the shop pretty near striking our men working near by.

There must be something wrong and we beg you to look over the whole electric plant and to test the transmission or what ever may cause this regular anxious appearances—so far naturel cause will allow a proportional safety.

You will highly oblige,
Yours resp.

News from the Companies

BOSTON OFFICE.

W. H. McGrath, manager of the Houghton properties, came to Boston about the first of August for a visit of a week, during which the arrangements for the Mohawk extension from Wolverine were completed.

Mr. Bradlee, Mr. Tripp, Mr. F. S. Pratt and many others have been away on vacations. Holidays go and come but like the lightning do not seem to strike twice in the same place.

Mr. C. F. Wallace left this office on August 19th for a trip abroad.

During the past year Mr. Howard F. Eaton has been making a study of the operation of railway properties under the Stone & Webster management. He now takes up work as acting-manager of the Brockton & Plymouth and the Blue Hill companies.

From position of manager of these companies Mr. Alba H. Warren has been transferred to fill the same position in the Pensacola company recently vacated by Mr. L. W. Leadley.

The Statistical Department has recently furnished Mr. William O. Batchelder, Lawrence Scientific School, 1905, to the Fort Worth company.

Three new men have joined the Statistical Department—Mr. Bradford B. Holmes, Massachusetts Institute of Technology, '08; Mr. Albert R. Chandler, University of Michigan, '08, and Donald W. Hartzell, Cornell, '08.

After a short period of service in the Statistical Department Mr. Donald Stuart, Cornell, '08, went to Tampa in the latter part of the month.

Mr. G. W. Lee, librarian, has been elected president of the New England Esperanto Association, a new organization to promote the interests of the proposed international language. It may be interesting to note that the United States Government sent an official representative to the fourth Esperanto Congress, held in Dresden in August.

Mr. J. C. Woodsome, superintendent Houghton County Electric Light Company, has been transferred to a similar position at Dallas, Texas, beginning September 1, 1908.

Mr. Ralph P. Gifford, assistant superintendent Houghton County Electric Light Company, has been promoted to fill the above vacancy, and Mr. Herbert Nash, Jr., of the Boston office, formerly with the Tampa and Pensacola companies, has been transferred to the position of assistant superintendent at Houghton, made vacant by the promotion of Mr. Gifford.

Mr. W. E. Terry of the treasurer's office is to be sent to Key West to take the place of Mr. J. J. Cronan, assistant treasurer, who returns to Boston.

Mr. James Cronan who has held a position in the office of the comptroller, Mr. A. S. Michener, has resigned to accept a place with "The Boston Traveller."

Mr. Wilmot has taken the position left vacant by Mr. Cronan.

The Engineering Corporation is engaged on an extension of five miles upon the system of the Houghton County Traction Co. from Wolverine to Mohawk, Mich. A car barn and a small sub-station are to be built in addition to the track, overhead work and bridges; and some new cars will be purchased. The work as planned will cost about \$125,000.

Mr. W. L. Locke of the Engineering Corporation has been placed in charge of the Houghton County Traction Extension, with headquarters at Calumet, Mich.

Improvements in the power station of The Lowell Electric Light Corporation will be made by the Engineering Corporation. Mechanical stokers for three boilers, a second stage feed water heater and a turbine ventilating system are included.

On July 28th the construction forces of the Engineering Corporation began clearing the site at Hauser Lake preparatory to the construction of the new 20,000 H. P. dam for the Missouri River Power Co. The contract was signed on July 11th, so no time has been lost in beginning the actual work. Timber purchases amounting to 2,000,000 cubic feet for the coffer dam have been made of the Grays Harbor Commercial Company of Seattle.

Mr. G. C. England, assistant treasurer of the Engineering Corporation, left Boston on August 16th for a trip which will include Helena and extend to the Puget Sound district.

Mr. F. R. Coates of the Engineering Corporation returned from a western trip on August 11th.

The Engineering Corporation has purchased for The Seattle Electric Company 1000 tons of high tee rails, which are to be laid in connection with paving of several streets. The order calls for

delivery in August and September and is placed with the Pennsylvania Steel Co.

A plan has been adopted by the Engineering Corporation for the systematic building up of a list of "Executives." It is aimed to have this list include all business executives and managers whose interests are actually involved in new construction work now, or which may be so involved in the future. Financial and manufacturing houses will be covered as well as public service companies, and the plan employs the co-operative effort of members of the staff in all departments.

BROCKTON, MASS.

A valuable real estate transfer has just been consummated, the Home National Bank acquiring a lot of land on School street directly opposite the City Hall and near the property of the Edison Co. It is understood that the bank is to erect a handsome brick building for its own occupancy.

Mr. B. E. Van Vleit of the Boston office is now engaged in auditing the books of the company.

The Westinghouse Church Kerr Co. has started the installation of a 20,000 volt testing transformer with induction regulator and control panel for use in testing our underground cables.

CANTON, MASS.

Mr. Warren left us on August 8th, and Mr. Eaton has been appointed acting manager of The Blue Hill and Brockton & Plymouth companies.

Our generator was repaired and put in operation August 2nd after having lightning through it.

The Park Commission has provided a series of nine band concerts, given on Sundays from 4 to 6 P. M.

The Stone & Webster Engineering Corporation is making a test of our power station and feeders. Mr. Vaugh has charge of the work.

Miss Dennison, stenographer, is spending her vacation at Hampton.

On August 8th we had about 1000 feet of trolley wire down, which made things lively and caused a delay of one hour and twenty minutes to our service.

(F. T. Buchanan.

LOWELL, MASS.

Mr. James H. Wood, our chief engineer, was recently married to Miss Jennie Lavallee of Dover, N. H.

Mr. N. T. Wilcox is spending several weeks at Lake Winnipiseogee, and we have received reports that he has secured many large bass.

A very welcome improvement has been made in the main street passing our office by the laying of granite block paving. The method of laying these blocks is to remove the road bed to the depth of about 24 inches, then to fill in with approximately 12 inches of trap rock. This is rolled and flushed with a thin solution of concrete. After this is set, a layer of sand is put on some four or five inches deep. Upon this sand the granite blocks are laid, and the crevices between the blocks are filled with a mixture of thin concrete and pin gravel. This leaves the surface of the street even, and practically smooth, but gives it sufficient roughness to prevent horses from slipping when the street is wet or somewhat icy. This makes a beautiful street, and will be a permanent improvement in the city.

WOONSOCKET, MASS.

During the past month we have received visits from Mr. Allen, Mr. Cheney, Mr. Henderson, and Mr. Locke, in connection with a contract which the Engineering Corporation has now started. This work covers the building of a 13,200 volt 3 phase transmission line, approximately ten miles, between Woonsocket, R. I., and Franklin, Mass.; the building of a transformer sub-station at Franklin, Mass., replacing the present steam plant, and driving our arc machines by motor drive, the incandescent and power service being supplied by stepdown transformers. The present Franklin plant supplies current only from dusk to daylight. With a new sub-station, 3 phase power service will be established, and with considerable reconstruction of the lines, 24-hour service will be supplied from the Woonsocket Station. At Woonsocket the scope of the work is as follows: Stepping up transformers for the transmission line; the erection of a 150 ft. steel stack and flue for three 284 horse power Aultman and Taylor boilers, already installed; a coal and ash handling overhead trolley system from the boiler room to the new coal pocket just completed by the company; the installation of one 375 Kw. 60 cycle, and one 170 Kw. 60 cycle generator for lighting and power service; switchboard panels for the Franklin transmission line, and the new 60 cycle system; some changes in piping for engines already installed, and a water weighing device are also a part of this contract.

The company has just built a 60 cycle, 3 phase, 2200 volt

transmission line from the Hamlet Textile Co.'s mill on the Blackstone river below Woonsocket, to transmit power, developed there by water, and purchased under contract from the Hamlet Textile Company.

Mr. O. A. Bridges is superintendent of construction and his organization includes Mr. Markle, Mr. Day, Mr. Munroe, Mr. Pearl and Mr. Green.

The work already completed is the preliminary survey of the transmission line to Franklin, showing pole locations, which has been made by Mr. Locke, who has now been transferred to the Houghton company on special track construction.

The company is at present reconstructing the distributing line for distribution of current at 60 cycle, replacing the 133 cycle system. The ultimate plan for Woonsocket is the elimination of the three-wire D. C. and 500-volt power systems.

On July 16th the mayor and city treasurer of the city of Woonsocket signed a contract with the company, covering arc and incandescent street lighting service for a period of five years from July 1, 1908.

This month the city council granted the Providence Telephone Company an exclusive franchise for a period of eight years.

Mr. H. S. Whitton, manager of the Ponce company made a flying trip to Woonsocket when on his vacation, and made an inspection of the Woonsocket and Franklin companies.

During the month of July the water in the Blackstone river was lower than has been recorded for many years. This has made it necessary to carry practically all of our railway and lighting load on our boiler plant, and we have been forced at times on heavy days to maintain an hourly load in excess of 3,000 kilowatts on this steam plant, which has a capacity of 1,400 horse power.

COLUMBUS, GA.

The weather in Columbus during July was unfavorable for street car travel, due to the fact that short but disagreeable showers and storms occurred almost every day during the month, usually towards the late afternoon when people were preparing for their evening pleasure riding or amusements. The rains ordinarily were not of such a nature as to do the crops either very much good or very much damage, but seemed to be very effective in the destroying of pleasure travel. The ordinary business travel on some of the lines which do no pleasure travel would indicate that we are per-

haps returning to a more normal condition of affairs in this part of the country.

The vacation period is upon us and leaves of absence have been, or are being, enjoyed by different members of the organization in different ways. Mr. C. J. Brooks went to Portland, Oregon, where he has relatives. He also called on Mr. Frank Dabney, assistant treasurer of the Seattle company, while in Seattle.

Mr. Wilbur made a short trip to Jacksonville, where he was very pleasantly entertained by members of the Electric Company.

Mr. W. E. Sherrer has returned from a visit to his old home in Georgia.

Mr. Neagle will leave shortly for Boston and vicinity, and Mr. Corse for an outing in Florida.

During the month Mr. Bleecker has been on business trips to Atlanta, Montgomery and Opelika.

We have received visits from Mr. Goodenough in connection with power station operation, and from Mr. Hunt prior to his leaving for Boston, and are glad to report the return of Mr. Hutchins from Savannah. Mr. Hutchins will undertake the work of making effective the changes in lighting rates recently decided upon by the company and approved by the general council and the board of trade.

Considerable enthusiasm on the part of members of the board of trade of Columbus and residents in Alabama at Society Hill, Marvin, Crawford and Tuskegee has been aroused over a proposed steam road, connecting Montgomery and Columbus and touching the various places named. A delegation of about fifty gentlemen from Alabama visited Columbus as guests of the board of trade, and after a meeting at the board of trade rooms were given a trolley ride and shown over the North Highlands power station, taken around the Belt Line by way of Wildwood, and finally escorted to the Rankin House and refreshed by a delightful luncheon served just before they left for the trains returning to their homes. It is hoped that the cordial relations existing between citizens of Columbus and citizens in Alabama will be strengthened by the construction of a steam road, which, from all reports, would be beneficial to all concerned.

Patterning after some of the larger cities, Columbus now enjoys a fresh air special electric car, which gives its patrons a twenty mile ride for ten cents, and which has been very well patronized during the month. This car leaves the transfer station

nightly, except Sunday, at 7.30 P. M., and goes over the different lines of the system for over two hours. While not a very heavy money maker, the car has so far been able to come out more than even, and has the advantage of keeping the citizens of Columbus in touch with the various parts of their city, which they otherwise might not visit frequently.

The Hudson Electric Company, one of the electric contractors of this city, has gained considerable fame recently by the use of an electric sign calling attention to buildings in the course of erection that it was wiring. While day signs of this character have been in use for some time in various cities, this is the first electric sign of this character with which the writer is familiar.

The success of the above described sign led the gas company to adopt an electric sign on top of a billboard on 12th Street reading "Cook With Gas." This being placed in a very prominent position in the city and tastily arranged, has caused much favorable comment and will probably be productive of good advertising results.

In connection with advertising, very effective and inexpensive demonstrations of electric irons have been given on Saturdays, by arranging with a regular laundress to bring to the display room her regular washing prepared for the ironing process, and there do her ironing with an electric iron instead of completing her labors with the usual and old fashioned kind. It has been found that the laundress considered the proposition a good one, as she was put to no expense for fuel and was able to keep cool by use of the electric iron operated under an electric fan. As the display room is used on Saturday morning by some of the ladies of one of the churches for cake sale purposes, this demonstration of electric irons was particularly beneficial on account of the number of ladies of the city who came in to see about cakes.

An interesting turn in the affairs of the city water plant has been taken in the modification of the original order by United States Judge Newman, which will permit the city to sell all of the bonds which were recently voted for the construction of a municipal water plant, instead of only a part of them, as was specified in his prior decision. The result of this has been the publication of an advertisement by the city, and it is possible that the bonds will be sold and work pushed on the city water plant in the near future.

During the month two benches of sixes at the gas plant were rebuilt and better results in this department are expected.

A contract has been signed by the city for plans for the new Dillingham Street bridge, which will probably be of the Melan type and will be erected under the supervision of the Superintendent of Public Works Campbell.

Columbus enjoyed, early in August, a visit from Mr. Leighton, chief hydrographer from Washington, who is visiting this section of the country with the idea of familiarizing himself with the water power and forestry conditions. Mr. Leighton will be remembered as being the author of numerous articles on forest preservation and waterways improvements, and it is hoped that his visit to this section will benefit him to the extent of his being able to be even more effective in the valuable work which he is doing along this line.

JACKSONVILLE, FLA.

The year of 1908 promises to eclipse all previous years in the matter of building operations in the city of Jacksonville. At the present time, more than \$3,000,000 is involved in the construction of new buildings, and the prediction is made that the new structures already erected since the first of January and those which will be completed by the end of the year will aggregate in value the sum of \$5,000,000.

No single year since the great fire in May, 1901, when the greater portion of the city was wiped out, entailing a loss of many millions of dollars, has witnessed the construction of so many fine buildings; and the visitor to Jacksonville during the coming winter season will look in admiration and surprise at the substantial and splendid improvements that have been made during the short space of twelve months.

Old shacks have been razed to make room for ten-story "skyscrapers," fine office buildings and business blocks have been erected on vacant lots, and modern dwellings have risen, phoenix-like, upon the desolate ruins that were left in the wake of the awful calamity. Renovations and improvements in the older structures are going on constantly, land and property values in all parts of the city and its suburbs have rapidly increased, and, best of all, this phenomenal growth is a most healthy one, being but the natural result of increased population and business demands.

There have been some people here who feared that the property owners were overdoing things, but they have changed their minds, for just as soon as a house or business block has been completed, it has been occupied; and there is a great demand yet to be met.

Prosperity is in the very air in Jacksonville and all these build-

ing operations, together with the deepening of the St. Johns river channel and many other river-front and internal improvements, are "signs of the times," and unless all signs fail Jacksonville faces an unusually brilliant and prosperous future. The Board of Trade is very active and every citizen is enthusiastic, hustling, and loyal. They are all boosters and pushers.

When it is said that nearly 12,250 building permits have been issued in Jacksonville in a little over seven years, or since the fire of May 3rd, 1901, and that the present year will, in all probability, rank as the record breaker, then it becomes perfectly clear why the progressive citizens are taking such a particular pride in their splendid city at this particular time.

During the month of July, alone, about 140 building permits were issued and a new monthly record was established for 1908. Nothing could better serve to emphasize the fact that the progress is remarkable, than the record of this single month. These July permits included nine brick buildings (three of which are to be three-story structures), forty-eight frame houses, twenty-seven one-story frame cottages, and sixty-four permits for repairs. In connection with the permits for repairs, it should be said that repairs costing under \$300 are not listed.

Among the new buildings just completed or in process of construction are hotels, bank buildings, business establishments, office buildings, a magnificent edifice that the Catholics of Jacksonville point to with great pride, and hundreds of dwellings in the city and its suburbs. In Springfield alone, about 125 new houses are going up.

Chief among the larger buildings are the Y. M. C. A. building, seven stories; the Bisbee office building, ten stories; the Atlantic National Bank building, ten stories; the Clarke building, five stories; the Commercial Bank building, ten stories and 105 feet square (and it is to be one of the finest buildings in the South); and the Masonic Temple, seven stories. This last named building is to have a 15-foot arcade from each of two streets, as an entrance to the Opera House which sets in the rear.

Manager Hardy Croom returned to the office on August 13th after an absence of about three weeks. While away from the city, he visited the Boston office and also went to New York City, Montreal, Can., and Buffalo, N. Y., for the purpose of looking into the operation of the new "pay-as-you-enter" cars, with the possible view of installing them in this city.

The Stone & Webster Engineering Corporation has completed work at the power house, and the office in this city has been discontinued after about a year's operation. The work has been in charge of A. J. Farnsworth, who has returned to the Boston office.

William E. Wood of the transportation department has returned from his vacation, which was spent in Charleston, Sullivan's Island, and Beaufort, South Carolina.

L. F. Whitehead of the Transportation Department has returned from his vacation.

K. A. Florens of the local office force started on his vacation August 15th.

A. A. Wilbur, assistant treasurer of the Columbus, Ga., companies, spent a few days in this city early in August as the guest of W. H. Tucker, assistant treasurer of the local company. Among the places visited was the Continental Hotel, Atlantic Beach, one of the beautiful hotels of the Florida East Coast Hotel Company, otherwise known as the Flagler hotels.

(Edward M. Carney.)

PENSACOLA, FLORIDA.

The Government is making extensive improvements on Santa Rosa Island at the quarantine station, where a number of new buildings are under construction. The work was awarded the Edwards Construction Company, of Tampa. Contract has also been entered into with Brewer & Jones, of Birmingham, Alabama, for the erection of a sea-wall around the fortifications on the western end of the island, to cost \$236,000. Buildings for quarters for the men are under construction, and also a commissary. This work will give employment to a number of skilled workmen, as well as common laborers.

The Government also recently finished a new life-saving station on the island, which was erected to replace the station destroyed in the storm of 1906.

When the recent Army Bill passed the Senate, the officers stationed at the three neighboring forts, Pickens, McRae and Barrancas, celebrated with bonfires and cheering. The illumination was noticeable in Pensacola, and caused much speculation as to its cause. It was the first time in the history of the posts that such a demonstration occurred.

A spirit of progress prevails among the financial institutions of Pensacola, which is evidenced by the more extensive quarters into which they have recently moved. The home of the First National Bank, which was recently taken possession of, ranks as the most

beautiful building in the city, and cost \$104,000, complete. The foundation is of polished Maine granite, while the structure is of white Georgia marble. The material for the cabinet work is imported mahogany of the finest grades from East India, San Domingo and Central America, and the marble used in the counters and wainscoting is from the Sienna quarries of Italy. The style of architecture is the pure Greek basilica, one of the most beautiful types of Grecian art.

The People's Bank has moved into the more commodious quarters vacated by the First National; and the Citizens' National has had to move out of the building recently occupied, which is being demolished to make room for the handsome new ten-story building to be erected by the American National Bank.

Mr. F. W. Hayes, formerly solicitor for the Pensacola Electric Company, has accepted the position of assistant postmaster, under the new incumbent, Mr. Rix M. Robinson. Mr. Hayes is from Rhode Island, and came to Pensacola in the employ of Stone & Webster, with whom he severed his connection early in January, 1908.

A bill was prepared by the Good Roads Convention, which met in Jacksonville in the early summer, which will be presented at the next session of the legislature. This bill provides for the creation of a commissioner who shall have the supervision of road building throughout the state.

In East and South Florida much has been done to improve the roads, but West Florida is greatly in need of such a movement, and great interest is manifested there, especially since the introduction of so many automobiles.

The county commissioners have taken up the subject, and have voted to bond the county for \$200,000, to be expended on three new bridges and roads. This will be acted upon at the next meeting. Twenty-year bonds bearing 5 per cent interest have been proposed. The subject of petrolithic paving has been brought to the attention of the commissioners, and investigations are to be made; this method of building roads is employed successfully in California. The greatest factor of success in its use is that at least 70 per cent of asphalt shall be contained in the oil mixed with the sand.

The park commissioners are most vigilant in their care of the parks, and great improvements are being inaugurated. Twenty-

four iron seats have been received for the Plaza, and cement walks have been laid through and around Seville Square.

Work was commenced on August 10th of demolishing the old Clubbs building on the corner of Palafox and Government streets, where the ten-story American National Bank building is to be erected. Contract for this work has been let to a St. Louis firm, the Selden-Break Construction Company.

Closer communication with Pensacola is sought by residents of Baldwin County, Alabama, who are agitating the question of a ferry between Escambia and Baldwin counties; some are in favor of a bridge across the Perdido river, but, in any event, the benefit to both Pensacola and the adjoining country will be great if either project is perfected.

The long talked of hotel, to be under the management of Charles B. Hervey, has grown into a reality of great promise to the city. Two local firms and one Mobile and one New Orleans firm are working together, at the suggestion of the building committee, for the materialization of plans for an eight-story hotel, which shall contain 280 sleeping rooms, about half of which are to have baths, and half of the baths are to be shower baths. Every room in the house will be an outside room.

The charter has been received from the state, and will be presented at the next meeting of the committee, on August 19th, when the issue of bonds will be discussed.

At the races held July 4th by the Y. M. C. A. boat club, a loving cup, presented by the Pensacola Electric Company, was contested for in a race between four oared shells. This cup is to be contested for during the year, and the crew holding it January 1st, 1909, will become the possessors. Much interest has been manifested in the races.

Work is progressing rapidly on installing the sewer system throughout the city, which will be completed early in September.

On August 6th, McCain, Fillingim and Maloney, the three men convicted of contempt of court in burning the Big Bayou Bridge belonging to the Pensacola Electric Company, were released from the county jail, where they had finished their term of 60 days imprisonment. They are to be tried at the next term of the criminal court, and are under \$2,500 bond for their appearance then.

The municipal venture, the city water works, was inaugurated July 1st, and the council authorized the Board of Bond Trustees to purchase a new pump. They are negotiating with the city of Wil-

mington, Delaware for a pump which that city has for sale, being replaced by a larger one. This pump has a capacity of 3,000,000 gallons, and is offered for \$5,000, the original price being \$17,000.

A discount of 5 per cent for payment of bills before the tenth of the month is to be allowed by the new management, and a cost of \$1.00 for connecting a meter which has been disconnected for non-payment of bills has been instituted.

A package car between Jacksonville and Pensacola has been put on recently to facilitate transportation of freight. This will give a five days' service between New York and Pensacola.

John R. Saunders, a naval stores man, died at his home in Pensacola, Monday morning, Aug. 10th, of apoplexy. Mr. Saunders came here about ten years ago, and was associated with numerous business enterprises in the city.

Mr. John W. Leadley left for Boston August 1st, and was joined by Mrs. Leadley a few days later. Mr. Leadley will take a long needed vacation before resuming his duties again.

Mr. H. H. Hunt, district manager, spent a day in Pensacola during July.

Mr. E. R. Adams, auditor for Stone & Webster, stopped over in Pensacola for a day on his way north from Texas.

Mr. Goodenough, of the Engineering Corporation, spent a day in Pensacola recently, coming here from Birmingham.

TAMPA, FLA.

The Tampa Electric Company has arranged for an up-to-date moving picture show with vaudeville specialties, and will endeavor to give its patrons a first-class, high grade performance at the Ballast Point casino.

The Royal theatre, situated immediately outside of De Soto Park, was burned to the ground on the morning of August 9th. This theatre was a new proposition, owned by W. G. Lynch, and was opened to the public on May 3rd this year, and had proved quite an attraction to the patrons of East Tampa. The origin of the fire is unknown, the general impression at the present time being that it was incendiary. The building loss is estimated at \$15,000, practically covered by insurance. It is reported that the Runkel Stock Company, who were playing in the theatre at the time of the fire, lost several thousand dollars in costumes and theatrical properties, without any insurance.

Mr. George R. Morse, formerly master mechanic of the Terre

Haute (Indiana) Company, has been appointed master mechanic of our company, and will have charge of our car barn and car repair department. Mr. Morse has had a number of years' experience in this particular work.

A number of very important contracts were closed on August 10th by the Seaboard Air Line railroad for the improvement of its terminal properties on Grassy Island just south of this city. This work has been contemplated for some time, but has been held up on account of the general business depression. The contracts represent a total outlay of \$500,000, and include the following: three wharves, total length 2400 feet; storage warehouse, 75 x 400 feet; phosphate elevator, 300 tons per hour; steel lift bridge and approaches, span of 187 feet from mainland to Grassy Island; spur track from Plant City, Arcadia and Gulf track, near Plant City, to plant of Coronet Phosphate Co.; dredging of channel, 350,000 cubic yards, to give 24 feet of water to docks.

BATON ROUGE, LA.

The work of reconstruction discontinued the last of March has been resumed and the Engineering Corporation, represented by Mr. George Priest, is about to commence work on the gas mains. The operating company is setting up the third 500 Kw. motor-generator set at the power plant; it has lowered the grates under two of the boilers from 30 degrees to 46 degrees, and has made a noticeable improvement in the steaming qualities of the boilers.

The continued rains of the last three weeks have about spoiled the prospects of a bumper crop this year, and the prospects do not look very bright for the planters hereabouts. The situation coming on top of a bad season last year, the rains have also affected our railway receipts considerably, as there has been quite a falling off in pleasure riding.

The legislature adjourned July 10th after a lively session of two months. A bill providing for state-wide prohibition was introduced, but failed to pass. The Locke bill prohibiting race-track gambling brought on the liveliest fight of the session, and was finally passed by one vote, resembling a similar bill passed in New York, when the deciding vote was cast by a senator who got up from a sick-bed to attend the meeting.

The bill in which we were most interested was one introduced in the Senate by one of the country members, providing for solid partitions in the street cars, separating the whites from the blacks,

instead of the screens now in use. That bill was killed very decisively, however, by a vote of 27 to 6.

Work on the Colorado Southern Railroad, building into Baton Rouge from Beaumont, Texas, which was discontinued some months ago, has been resumed, and it will not be long before both this road and the Southern Pacific will be running trains into this city.

The Mississippi River reached an unusually high stage this summer, rising as high as 40.5 feet above low water mark and causing a great deal of anxiety along the water front. The Yazoo and Mississippi Valley Railroad began raising its tracks, but the river commenced to fall before any damage was done.

Mr. C. S. Goodwin, accountant for the Stone & Webster Engineering Corporation, arrived here from Boston, August 5th.

(E. A. Davis.)

DALLAS, TEXAS.

Mr. J. B. White, who for the past two years has been assistant to the superintendent of railways, has gone to El Paso, where he has accepted a position with the El Paso Electric Company. Mr. W. W. Loomis, formerly purchasing agent, has succeeded Mr. White, and Mr. P. A. Pitcher, of the accounting department, succeeds Mr. Loomis as purchasing agent.

The Dallas Consolidated Electric Street Railway Company has just completed a new sprinkler of the McGuire, Cummings turbine pump type, capacity 4000 gallons.

EL PASO, TEX.

On August 1st, 1908, Mr. Henry Seggermann became the company's representative in Juarez, Mexico, in place of Mr. Max Weber, who resigned. Mr. Seggermann has also been elected vice-president of the El Paso & Juarez Traction Company, in place of Mr. Weber.

It has been decided to change the fuel used in El Paso from slack coal back to oil, beginning on September 1st, 1908. In this connection, it may be of interest to state that during the past five or six years the price of fuel oil in El Paso has been subject to tremendous variations. In the early days of the Company, 1902, in spite of a freight rates of \$.55 per barrel, we could obtain fuel oil f. o. b. cars, El Paso, for \$.69. The price gradually rose after that time, due to the fact that oil became more and more popular as a form of fuel in Texas, until in the summer of 1907 we were paying as high as \$1.63 per barrel for fuel oil, and this Company

at that time discontinued the use of oil for fuel and began using slack coal. Oil is now down to \$1.05 per barrel which justifies the return to its use, and the company has recently made a year's contract at the above figure.

The city is very energetically extending its arrangements for street lights and police, and during the coming summer will increase the number of its street lights by about twenty-five per cent. The city and the public generally are also co-operating with the company in the extension of its system of commercial street arc lighting, consisting of arc lights on ornamental iron poles, placed about fifty feet apart on the business streets. By the end of the summer we shall have about 180 arc lamps installed on this basis.

The General Electric Company has recently finished the reconstruction of our No. 3 turbine, so that all of our turbo generators are now in good operating condition.

Signs of returning prosperity are beginning to be noticeable in the Southwest, especially in the renewed activity in the copper mining districts of New Mexico, Old Mexico and Arizona, and it seems to be the feeling on all sides that the good times will be back again this fall.

(C. W. Kellogg, Jr.)

HOUSTON, TEX.

Of the phenomenal growth of the Southwest much has been said; but nowhere has the fact been more keenly appreciated than in the street railway business of the large cities of Texas.

Houston, one of the foremost of these, has doubled its population in six years and is unquestionably the greatest railroad center in the Southwest. It is also the headquarters for the rice, timber, cotton and oil industries of the State.

While the growth of the city in the past has been very remarkable, it is believed that in the future it will advance with even greater strides.

That the company were aware of this fact was shown by their decision to abandon their old car barns near the heart of the city which were already over-crowded, and to buy in the suburbs, where more advantageous grounds could be had.

The site chosen consists of ten acres at the end of one of the belt lines, and about two miles from the business center of the city. The new barns are located in the west half of the property and consist of a car shed, machine, carpenter and paint shops, a store room, and several smaller buildings.



The buildings are all of wood, double-sheathed, and covered with heavy corrugated galvanized iron.

The roofing material is an asbestos composition, coated with asphaltum and covered with ground asbestos rock; hence it will be seen that, so far as external agents are concerned, the buildings are fire-proof.

In this instance the name is well applied, as the structure is truly a shed, inasmuch as it has three sides open. Rolling doors were not even deemed necessary, the climate of Houston being so mild.

The car shed is separated from the shop by a 17 in. brick fire-wall, the only two openings of which are protected by self-closing fire doors.

The shed is 158 ft. x 230 ft. and covers twelve tracks, eight of which are pitted, the remaining four being used for the storage of out-of-season cars.

The pit area is very ample, being approximately 100 ft. x 220 ft., allowing, in other words, for the inspection of about 50 thirty-foot cars without the necessity of shifting.

The earth taken out of the pit was used in raising the grounds nearest the buildings, thus getting very good drainage on an otherwise flat piece of ground. A system of open concrete drains carries the rain-water outside the property to ditches.

One-half the shop is taken up by three elevated tracks extending full length of the building. The other half is divided into machine shop proper, armature winding room, carpenter shop and paint room. The paint room is separated from the other shop by a partition and large glass panel doors.

That portion of the shop building containing the three elevated tracks is of very massive design, the posts, knee-braces, and trusses being exceptionally heavy. This was made necessary by the overhead lifting device for car bodies, which runs the entire length of the building, and is a feature of the design.

Other buildings which have subsequently been built are: Blacksmith shop, 30 ft. x 40 ft., small sand drying house, oil house, and air-compressor house under the steel tank. The construction of all is similar to that of the main building, viz., wood frame work covered with galvanized iron.

Inasmuch as the new property is in the suburbs, and half-mile from the city mains, the company had to supply its own water system, both for fire protection and for general use.

The system consists of an artesian well (motor-driven Ingersoll-Rand, 134 cubic foot per minute capacity), an air compressor for air lift, a 25,000 gallon steel tank with hemispherical bottom on a 60 ft. tower and 6 in. mains surrounding the buildings. Hose-houses are built around the hydrants containing hose coupled ready for use.

The air-compressor serves also to supply the machine and blacksmith shops.

The city is now extending its main, and before long the company hopes to be able to make a connection for emergency use.

There are fifteen tracks in all, nine of which go through the shed and connect with ladder-tracks on either end. The curves are all easy, none having a shorter radius than 75 ft.

The features of the work are: Symmetry of switch groups and avoidance of frog complications; resulting in an excellent layout at a comparatively low price.

The chief consideration that was borne in mind, in the present design of track and buildings, was that of enlarging or duplicating either the trackage or the buildings, or both; and as already mentioned, the rapid growth of the city and of the street railway system, and the possibility of other developments, indicate that even the present plant may soon be inadequate to the company's needs.

(Flint McGregor.)

PADUCAH, KY.

Citizens of Paducah are very much pleased over the fact that the city directory just issued shows a marked increase in population over the one issued in 1906. Business conditions are gradually getting back to normal again. The railroads are putting men on the road, and the shops have been opened on full time. Several large factories have resumed operation.

On June 25th, our No. 9 engine, which is a simple Russell, 27 x 30 inches, showed a crack in the cross head. The load had just been taken from the engine and one of the engineers discovered the small part of the crack which showed, the rest being under the guides. We were able to get a new forged cross head in place ready to run in four days. This engine drives one of the 300 Kw. motor-generators as a generator, over the peak.

A peculiar accident happened to one of our railway watt meters recently. The meter was seen to be burning from some cause just after the machine had been taken off. It was also noticed that the field switch arched heavily. An examination

showed an open circuit in the kicking coil and the kick had evidently gone into the meter, injuring it to the extent of burned fields and leads. The machine showed no injury.

An interesting and successful Chautauqua meeting was held for ten days during July at Wallace Park. Plans are already being formed for the next year's meeting.

The Eighth of August, the most important holiday of the year to the colored people, was celebrated as usual, although not so many excursionists came to Paducah this year. There were only about 4,000, less than half the number here last year.

The Farmers' Union, which met here the first week in August, was quite well attended, about 500 members being present.

President Joseph L. Friedman is in Colorado on a month's hunting trip.

Mr. H. T. Brown, formerly superintendent of construction for the Stone & Webster Engineering Corporation and now engineer from the Nashville office of the General Electric Company, visited the company last week.

Mr. H. C. Foss, general superintendent, has returned from a vacation trip to Tennessee.

HOUGHTON COUNTY, MICH.

Few people outside of the Copper Country realize the amount of shipping that passes through Portage Lake. A few figures from the report of commerce during the month of July will give some idea of its extent. We also give the corresponding figures for July 1907, as a more or less interesting condition of affairs is shown by this comparison:

	July 1907	July 1908
Total number of vessels..	614	520
Total tonnage	350,317 tons	376,876 tons
Coal	200,545 "	241,944 "
Misc. Merchandise.....	26,872 "	25,831 "
Total Cargo.....	313,506 "	330,612 "
Passengers	18,210 "	17,402 "

It should be noted in the above that while the number of vessels has decreased the tonnage has increased. This is probably due to the fact that some of the larger boats formerly handling ore from Superior and Duluth are now bringing coal into this district. It is further true, however, that this year a greater number of the boats after bringing coal up are returning in ballast to southern shipping points. The increase in coal we explain as due to the

lack of other freight, the coal being handled earlier in the season than is usual. As a whole, the above figures would seem to show that this year's commerce of the copper country is on a par with that of other years.

The annual reunion of the Sons of St. George was held recently in the city of Hancock. The society brought to the city the street fair of the Parker Amusement Company as a special attraction for the week. Many people from all parts of the State came to Hancock for this occasion. The electric illumination of Quincy street and the City Hall was commented on by many of the visitors.

The annual meeting of The Houghton County Street Railway Company was held in Houghton during the past month. The same officers were elected for the ensuing year, with the exception that Mr. Henry G. Bradlee resigned as Vice-President, Mr. F. S. Pratt being elected in his place.

A satisfactory agreement was made between R. S. Blome & Co., who are doing the paving in Laurium, and the Railway Company, so that it was not necessary to stop the cars from running through the village of Laurium during the paving work. One track of the double track was removed, and the time schedule has been satisfactorily maintained over the single track.

The street railway company has recently adopted a wood plug bushing for use in connection with the trolley wheels. These bushings are so constructed that the oil is fed from a reservoir through wooden plugs to the axle. It is estimated that a saving of approximately 50 per cent. has been made in the maintenance of bushing and trolley wheels.

An agreement has been made between The Houghton County Street Railway Company and the United States and Dominion Transportation Company for a joint passenger tariff between Red Jacket and Portage Entry on the shore of Keweenaw Bay. This agreement gives a reduced rate on round trip tickets between these two points. At Portage Entry there is located a popular dancing pavillion, and it is hoped that considerable business will be derived by this new tariff.

Work has been started on a new 11,000 volt transmission line from Laurium north. The poles are already delivered on the ground, and some few have been erected. This line will be approximately five miles long; four and one-half miles, besides carrying the high tension wires of the lighting company, will also carry the overhead construction of the electric railway extension to

Mohawk. The work is being done by Mr. Brooks, line foreman of the lighting company, and is expected to be finished by the middle of October.

Mr. A. W. Leonard, manager of the General Electric Company, Minneapolis, made us a short visit in August. He was accompanied by Mrs. Leonard and was joined in Houghton by Mr. and Mrs. McGrath, the whole party making a trip on the lakes as far as Cleveland.

MINNEAPOLIS, MINN.

With the constantly increasing business along the line of sign and window lighting and of flat rate lighting, it has been found necessary to organize a sub-department in the operating end of this company to handle this class of operating work. At the head of this department was placed the foreman of the arc department. The purpose of this new department is more effectively to control the maintenance of all schedule lighting under the guidance and personal supervision of one man, to whom all flat rate switchmen, repairmen, trimmers, etc., report, and who is responsible for results. Daily inspection of all lighting placed under this department has been established, with the result that renewals are well looked after. This new method of handling all contract lighting will not only aid greatly in giving better results from an operating standpoint, but customers should materially profit by better service. This will result in increased confidence of the commercial users of electric light, and should further help to increase greatly this class of business.

A new twelve-story hotel is just being erected that, architecturally, will be a great addition to this city. The two upper stories are to be occupied by the Commercial Club, who are to give special attention to the decorative effects, spending \$50,000 alone to obtain the best result that the architect can produce. This entire building is to have specially designed fixtures fitted with tungsten lamps, and will present, when finished, a product of illuminating engineering excelled in few cities.

Four high school buildings have recently been connected up and will add to a considerable degree to our load. These buildings are fitted throughout with light and power. Power is used extensively for drive in the normal training departments, which lately have been adopted by all schools of the upper grades in this city.

The accounting department has purchased an automatic bill folding machine which eliminates much of the former labor on

this work. The bills are folded by the machine, sealed in open faced envelopes and distributed throughout the city by boys.

Upon receipt of the quarterly dividend notice of the Stone & Webster Employees' Investment Association the following notice of the local agency was posted on the various bulletin boards in all departments of this organization:

Statement of Minneapolis Agency, July 31, 1908

Total Deposits.....	\$22,239.65
279 depositors—average deposit.....	281.51
Smallest deposit.....	2.38
Largest deposit.....	3,329.33
Interest for quarter ending July 15th.	
Rate of 6 per cent. per annum, com- pound quarterly, amount of interest..	306.31
Rate of interest paid since organization—	
1903.....	10.65 per cent.
1904.....	8.08 per cent.
1905.....	8.10 per cent.
1906.....	10.11 per cent.
1907.....	9.14 per cent.
*1908.....	6 per cent.

* Low rate of interest due to financial panic.

This is an excellent opportunity for a Safe
and Paying Investment.

This resulted in an increase of deposits amounting in ten days to \$806.10, and also the opening of two new accounts.

Mr. E. K. Barnham—former superintendent of the St. Croix Water Power development—has recently left this Company's employ on short notice to assume a position with the Stone & Webster Engineering Corporation at its new undertaking in Helena, Montana.

A 100 watt "sirius" tungsten lamp on life test has recently burnt out, burning in all 1440 hours. An American General Electric tungsten formerly burnt under the same conditions 6240 hours. This speaks well for our future lamp market, especially in view of the fact that in our western states tungsten is now being found in marketable quantities.

Mr. Jefferson L. Alexander recently chief engineer of the Ponce Electric Co., Porto Rico, arrived in Minneapolis, Aug. 17th.

It is expected that he will fill a position in the department of the Superintendent of Power.

(R. H. McGrath.)

EVERETT, WASH.

The decision of the Interstate Commerce Commission adjusting the lumber and shingle rates from North Coast points has had a decidedly favorable bearing on the lumber business, which is reflected in a corresponding revival in general trade conditions in western Washington. Although practically all mills in this city and vicinity are now in operation, a considerable period must necessarily elapse before business reaches a normal basis.

Everett is probably the greatest shingle manufacturing center in the world, and the nine large lumber mills with a combined annual output of 278,187,000 feet show what an important factor this industry is.

There was recently held in this city a convention for the purpose of devising an economical method of clearing logged-off lands. Representatives from Oregon, British Columbia and various points in western Washington were present, as was also a representative of the Agricultural Department of the Federal Government. This convention attracted a great deal of attention, and it is the confident assumption of those taking part in the proceedings that a solution of the question will be evolved that will greatly expedite and cheapen the work of fitting the logged-off lands of this section for agricultural purposes. A permanent organization was effected, and experts have been detailed by the Federal Government to conduct experimental work. How to clear up the vast areas of logged-off lands cheaply and rapidly is the most important problem now confronting the people of this section.

In Everett is located the only water system operated by the Stone & Webster interests. This was taken over by the Puget Sound International Railway & Power Co., together with the railway and light departments of the old Everett Railway, Light and Water Co. The water plant has been in operation seventeen years. During this period it has been developed from a well, supplying a population of a few hundred, to its present capacity of about three and one-half million gallons per day with sixty miles of water mains. The city has again for the third time outgrown its water supply, and extraordinary efforts are being made by the management during the dry season to conserve it. So far every one

has all the water needed, and liberal regulations as regards sprinkling hours still prevail.

A substantial growth of the lighting load still continues. It is estimated that fully one thousand residences were erected during the past twelve months, nearly every one of which is wired for electric light.

Ray C. Phelps, formerly with the Pueblo Suburban Traction & Lighting Co. of Victor, Colo., has succeeded J. A. Juleen as contract agent.

(Louis Leah.)

PONCE, PORTO RICO.

On Saturday, July 25th, the tenth anniversary of the landing of the American forces in Porto Rico, a celebration was held in Ponce which was attended by the Governor and several other high officials of the insular government. The morning was devoted to a review of the Cuerpo de Bomberos (the volunteer firemen). They marched in review before the Governor and the city officials, and were highly complimented on their neat appearance and the fine condition of their apparatus. This latter is of very antiquated type, being composed of hand tubs, two wheeled reels, a very small ladder truck, and an emergency cart for the care of the injured, all drawn by hand. Alarms are given by means of bugles and whistles, there being no fire alarm telegraph service in the city.

In the afternoon there were horse races in the Hipodromo, which were well attended and which proved to be very exciting. They were conducted in a far more satisfactory manner than any of the previous ones, especially as regards intervals between events. Formally, long waits have been the rule, but at these races everything went off promptly. Rain interfered with the last race, but it was run off nevertheless and was won by Perla Fina, a horse that had never before won on a wet track, but had always won on a dry one. The cars of this company were crowded most of the afternoon; but as some of the people waited for the rain to cease before returning from the races, we were not swamped by the returning crowd as we were the previous year.

In the evening a dance at the Casino de Ponce served as a fitting and to an eventful day.

We have been experiencing heavy rains the past few weeks, and as a result the cane growers are expecting a much better crop than last year. This should soon cause our business to improve,

as we are dependent on good conditions in the cane fields for much of our railway traffic.

There seems of late to be increased interest in electric motors, and we have inquiries concerning about fifty horsepower additional. This is made up of one 25 HP unit and several smaller ones.

Several very slight earthquake shocks have been felt here lately, but nothing serious is looked for.

Mr. Jeff. L. Alexander, chief engineer, and Mr. Walter P. Ingham, railway superintendent, are away on vacation at the present time.

The entire island is more or less excited over the approaching elections, which will be held in November in order to fill the following positions: delegate to Washington, judge and marshal of the several municipal courts, and marshal and secretary of the district courts. Rallies are being held every few evenings, and enthusiasm reigns in all quarters.

QUOTATIONS

ON

SECURITIES OF PUBLIC SERVICE CORPORATIONS

UNDER THE MANAGEMENT OF

OUR ORGANIZATION

AUGUST 20, 1908

NOTE:—Quotations are approximate. Unless indicated to the contrary Bonds and Notes are 5 per cent and preferred stocks 6 per cent non-cumulative. Accrued interest should be added to quotations on Bonds and Notes.

COMPANY	BONDS	PREF.	COM.
Blue Hill Street Railway Co., The	95	No pref.	....
Brockton & Plymouth St. Ry. Co.	93 ¹¹	No pref.	....
Cape Breton Electric Co., Ltd.	90	75	15
Columbus Electric Co.	90	....	....
Columbus Power Co., The	93	....	....
Notes	95		
Dallas Electric Corporation ^{7, 8}	85	50 ³	15
Edison Elec. Ill. Co. of Brockton	105½	No pref.	155
Notes	100		
Electric Light and Power Co. of Abington and Rockland	100	No pref.	150
El Paso Electric Co. ⁸	92½	85	41
Notes	96 ⁴		
Fall River Gas Works Co.	No bonds	No pref.	245
Galveston Electric Co.	92½	....	....
Galveston-Houston Elec. Co.	....	85 ¹	80
Houghton County Elec. Lt. Co.	97	22½ ⁶	15 ⁵
Houghton County St. Ry. Co., The	92½	92½ ¹	20
Houston Electric Co. ^{6, 7}	98	....	....
Jacksonville Electric Co.	93	95	80

COMPANY	BONDS	PREF.	OOM.
Key West Electric Co., The	....	....	....
Lowell Elec. Lt. Corporation, The	100	No pref.	188
Minneapolis General Elec. Co., The	98 Notes 100	100 ^{1, 6}	85 ⁶
Northern Texas Electric Co.	96 ² Notes 97 $\frac{3}{4}$	82 ⁷	80 ⁷
Pacific Coast Power Co.			60 ⁶
Paducah Traction & Lt. Co.	80	50 ^{1, 3}	15
Pensacola Electric Co.	95	75 ¹	20
Ponce Electric Co.	100 ⁴	No pref.	....
Puget Sound Electric Railway	97 ⁶ Notes, 1911 96 Notes, 1912 95	87	41
Puget Sound Power Co.	97 $\frac{1}{2}$	No pref.	....⁹
Savannah Electric Co.	80	50	12 $\frac{1}{2}$ ^{6, 7}
Seattle Electric Co., The	102 ^{6, 7, 8} Consol. and Refund m'tge convertible 98 " " " " non-con. 96 $\frac{1}{2}$ Notes 96 $\frac{3}{4}$	95 ^{6, 7, 8}	80 ^{6, 7, 8}
Tacoma Railway & Power Co.	95	No pref.	....¹⁰
Tampa Electric Co.	98 $\frac{1}{4}$	No pref.	105
Whatcom County Ry. & Lt. Co.	92 $\frac{1}{2}$	87 $\frac{1}{2}$ ¹	38

1.—Cumulative. 2.—Bonds of Northern Texas Traction Co. 3.—5 per cent. 4.—6 per cent. 5.—Par \$25. 6.—Listed Boston. 7.—Listed Louisville. 8.—Listed Columbus, Ohio. 9.—Held by The Seattle Electric Co. 10.—Held by Puget Sound Elec. Ry. 11.—4 $\frac{1}{2}$ per cent.

STONE & WEBSTER

Boston - - - - 147 Milk Street
Chicago, 604 First National Bank Bldg.

NOTE.—The Securities Department handles securities for those wishing to purchase or sell. Requests for information in regard to any of the above companies will be promptly answered at any time by this Department.

COUPONS AND DIVIDENDS DUE

	Per Cent
Sept. 1st. Edison Electric Illuminating Company of Brockton, coupon notes, 1921.....	2½
Sept. 1st. Galveston Electric Company, preferred stock, 6 per cent.....	3
Sept. 1st. Northern Texas Electric Company, preferred stock, 6 per cent.....	3
Sept. 1st. Terre Haute Traction & Light Company, preferred stock, 6 per cent.....	3
Sept. 1st. Whatcom County Railway & Light Company, preferred stock, 6 per cent.....	3
Sept. 15th. Galveston-Houston Electric Company, The, preferred stock, 6 per cent.....	3
Oct. 1st. Blue Hill Street Railway Company, The, First Mortgage 5's, 1923.....	2½
Oct. 1st. Columbus Electric Company, First Mortgage Collateral Trust 5's, 1933.....	2½
Oct. 1st. Columbus Power Company, The, First Mortgage 5's, 1936.....	2½
Oct. 1st. Columbus Power Company, The, coupon notes, 5 per cent, 1911.....	2½
Oct. 1st. Columbus Railroad Company, First Mortgage 5's, 1937	2½
Oct. 1st. Dallas Electric Corporation, First Mortgage Collateral Trust 5's, 1922.....	2½
Oct. 1st. Electric Light & Power Co. of Abington & Rockland, The, First Mortgage 5's, 1919.....	2½
Oct. 1st. Everett Railway & Electric Company, First Mortgage 5's, 1921.....	2½
Oct. 1st. Everett Railway, Light & Water Company, Consolidated Mortgage 5's, 1925.....	2½
Oct. 1st. Tacoma Railway & Power Company, First Mortgage 5's, 1929.....	2½
Oct. 1st. Houghton County Street Railway Co., The, preferred stock, 6 per cent.....	3
Oct. 1st. Seattle Electric Company, The, preferred stock, 6 per cent.....	3

RECENT ADDITIONS TO THE LIBRARY

"Commercial America," 1907, is a 175-page pamphlet, 9 x 12 inches, recently published by the Department of Commerce and Labor, Bureau of Statistics, which may be obtained of the Superintendent of Documents, Washington, D. C., for 25c. in coin or post office order. It shows the "commerce, production, transportation facilities, area and population of each of the countries of North, South and Central America and the West Indies." About one-third is text, the rest statistical tables. It appears to be an exceedingly valuable publication.

Recently received from the Chief Clerk of the United States Geological Survey is a four-page pamphlet in which the many uses of the topographic maps, particularly by departments of the Government, are illustrated. Accompanying it is a circular letter saying, "This pamphlet will be revised later, as additional uses may be reported, *and your correspondence is solicited on the professional uses which you make of the maps.*" The letter also says: "As the actual user of a map *you may discover omissions or note changes made in the culture since the area was surveyed which it would be of great importance to record for use in revising future editions. It is the desire to make these maps of the highest possible value in every way, and your co-operation in this matter will be fully appreciated.*"

"Notes on Hydro-Electric Developments," by Preston Player, 68 pages, 5 x 7 1-2 inches, \$1 (McGraw Publishing Co., New York), should be of interest to the projector and promoter. It deals with:—engineering examination; the extent of the market for energy; cost of energy manufacture; central station economics; sale of electric energy; primary and secondary powers; capital costs. It is "the object of this short discussion to indicate, as far as possible, the information which should be obtained in order to afford a definite basis for forming a decision as to the merits of any proposed undertaking." r. Player was formerly with Stone & Webster.

The following publications have been subscribed for and come regularly to the Library:

"Printer's Ink" and "Profitable Advertising," both advertising magazines; "The Financial World," and "The Moody Manual Service, a Monthly Guide to Railroads and Corporation Securities."

LIBRARY OF STONE & WEBSTER

Current Literature

Selections from Recent Magazines and Book Accessions.

We print below some of the more important recent references. Ed, *, and + are used in cases of magazines to indicate editorial, illustration, and map or diagram, respectively. But these symbols do not have the same significance in the case of book numbers, all of which are preceded by an asterisk.

Lighting.

- 1 Modern system of street lighting: use of luminous arc by Worcester Electric Light Co; three methods of suspension station outfit; wiring; data showing comparison of old and new system. CABHalvorson. GenElecRev-8|08-65-4.9p*+

Motors and Transmission.

- 2 The induction motor, its characteristics in relation to industrial applications. AMDudley. Electric Jrnl-7|08-366-19.5p+
- 3 Pr transmsn: a comparative study of the merits of gas & ely; gas-engine substations; long-distance gas transmsn; two alternate schemes. ProfCASmith. CassiersMag-7|08-275-5p+

Steam Engineering.

- 4 Economy tests of high speed engines: conditions & results of tests to determine economy & efficiency of non-condensing reciprocating stm engines in actual operation. Abs, FWDean & AC Wood & dis. Power-7|14|08-68-6p*+
- 5 Storage & handling of coal & ashes in pr plts: two classes of storage; methods of handling described. WernerBroecklin. Cassiers Mag-7|08-235 21.5p*+

Mining.

- 6 World's copper supplies in 1907: I. Relationship between the total world output of copper & the production of the USA mines. II. Changes in relative position of the 8 leading copper-producing countries during the period 1898-1907. III. Variations in price for the past 25 yrs. JBCKershaw. CassiersMag-7|08-202-7.1p+

Railway Affairs.

- 7 Revised classification of accounts for electric rys; by Interstate Commerce Commn; for adoption 10|1|08; modifications of Circular 20. StRyBull-7|08-380-2p

Public Relations.

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BY

JOHN BURNET

OF THE UNIVERSITY OF OXFORD

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PUBLIC SERVICE JOURNAL

OCTOBER 1908

EDITORIAL COMMENT

Practically a year has elapsed since the panic. The recovery has been slow, though in most lines it has, admittedly, been sure. The stock market has progressed faster toward normal conditions than the industrial world. For example, the twenty-five leading securities at the New York Stock Exchange which are usually regarded as the barometer of the market showed an average at the close of September 23 of 85.12, as against 82.76 on the corresponding date in 1907, or before the panic struck the country. The significant fact is that on February 17, 1908, they showed an average of only 67.87. General trade is still being conducted largely on a hand-to-mouth basis, though in many lines merchants have noted encouraging symptoms in the last few weeks. As this was pre-eminently a rich man's panic the market for luxuries is perhaps not a bad barometer of general conditions. Possibly there is some significance in the fact that the large jewellers and dealers in diamonds, precious stones, and semi-precious stones declare that since the middle of August things have picked up in quite a lively fashion.

* * *

The wisdom of the heavy semi-convertible car for city and suburban street railway service is discussed by Mr. Lee H. Parker in this issue. His conclusion is against such use, the reasons which he adduces being of an economic character. He finds that this car

weighs fully 100 per cent more than the cars with which we have been familiar in the past. Where, as in city and suburban service, the stops are frequent, the cost of the energy required to accelerate the cars from stop to full or partial speed is a matter for serious consideration, the power needed during the accelerating period being from three to five times that necessary to propel at full speed. It is also contended that, in most cases, the heavy cars are of no particular value except during rush hours—that is, for about four hours out of eighteen—and that for the larger part of the time the light and comparatively inexpensive cars are sufficient to handle the business. In fact, it is necessary to consider the relative cost of the two kinds of cars, power stations, maintenance, wages, etc. All the data needed for a comparative study of the cost of the two types of car Mr. Parker has endeavored to embody succinctly in a single comprehensive table. The result is an effort which must be of value to all interested in street railway affairs. The subject is admittedly one of importance, one on which, it is generally agreed, the last word has by no means yet been uttered. It would be interesting to hear the comment excited by Mr. Parker's conclusions in the minds of others who have given the subject consideration, and we may add that the pages of the Journal will be open to those who may care to contribute to the discussion which he has started.

* * *

"Public Service" for September has a long and highly entertaining article on "Three Cent Traction Service." It is "a study of conditions in Cleveland, Ohio." We commend it to all readers of the Journal. And in this connection we may be allowed to call attention to a humorous, but really significant, allusion in the Boston Transcript of September 23. In the political columns of that paper appeared a letter from a special correspondent in Cleveland, who declares that it is next to impossible to hear any talk in Cleveland about Taft or Bryan. "When one came into Cleveland it was easily made plain why this was so. There is to be a referendum here on Oct. 22 to decide the validity of a street railway franchise or something of that sort. This is not the year nor the time nor the place to inflict upon an outside world Cleveland's traction troubles. But the morning newspapers today give their most conspicuous news space to a discussion of the phases of the coming election. Posted in conspicuous positions in the street cars are placards showing the operating expenses, profits and deficit of the

street railway line during the last three months. The coming generation in Cleveland bids fair to be one of chartered street railways accountants. Even the men who sell cigars at the little corner stands can and will talk volubly and apparently learnedly about franchises, earnings, operating expenses and every complicated and involved feature of the operation of traction lines in a city of 500,000 people. Their passion for and grasp of the subject are nothing short of marvellous to the man from a city where the average citizen knows nothing more about urban transportation than the location of the transfer points. But it is distinctly a nuisance to find people so wrapped up in their own affairs in a year when presidents and governors, members of Congress and legislators are being elected."

* * *

"A Study of the Conditions Affecting the Price at Which Capital Can Be Secured to Develop Public Utilities" is the title of a very timely article in the September number of *Moody's Magazine*. The subject is introduced in this manner: "Inasmuch as public service companies receive from the communities which they serve, certain special privileges, it is plain that they owe certain duties in return. First among these in point of time, and possibly in importance, is the duty of raising the capital for the construction of their plants on a basis which will result in the lowest possible charge on their revenues, and, consequently, the sale of their products or services at the lowest possible prices." The object of the article is to consider the conditions which affect the price at which such capital can be secured, and to suggest a method of determining what constitutes a fair price in any given case. These are certainly the most fundamental considerations which affect public service corporations, and they are probably the ones to which the general public give least thought in their discussion of the relations of the public service corporations to the public. *Moody's* article develops the subject in a systematic fashion, though not with all the fullness that might be desired, owing, obviously, to the limitations of space.

Enforced Competition

"Enforced Railroad Competition" is the title of an acute article in the September *Atlantic Monthly* by Mr. Ray Morris, editor of the *Railroad Age Gazette*. Where it does not convince

it will certainly excite reflection. It recalls sharply to our attention that there are two sides to this question as to all other questions; its tendency is to make thoughtful and unbiassed minds feel that the last word has not yet been uttered with reference to enforced competition.

Mr. Morris is a very clever writer. His skill in arranging and presenting the facts of his argument is exceptional. A striking feature of his article is the ability with which he brings out the fact that "the railroads are told with blunt plainness that they must compete, and are then immediately reminded that they must not." This incongruity confronts the reader at the outset: his mind is immediately bent on discovering all the writer has to say with reference to it; and when he has finished the article he finds that he has said a great many things that call for answer.

Mr. Morris makes an interesting allusion to past attempts to enforce competition by law. He recalls that Mr. Charles Francis Adams showed that it had always been the theory in England that the railroads ought to compete, until the commission of 1872 demonstrated that in the forty years since railroads began, English railroad legislation had never accomplished anything which it had sought to bring about, nor prevented anything it sought to hinder. Thirty-three hundred useless enactments had cost the companies eighty million pounds (about \$400,000,000), but the commission reported that competition between railroads existed only to a limited extent, and that it could not be maintained by legislation. The commission cited the case of the North Eastern Railway, formerly composed of thirty-seven independent, competing, and more-or-less bankrupt companies, but in 1872 (as today) prosperous and giving general satisfaction, and found that in view of such facts as this it was clear that amalgamation had "not brought with it the evils that were anticipated, but that in any event, long and varied experience had fully demonstrated the fact that, while Parliament might hinder and thwart, it could not prevent it, and it was equally powerless to lay down any general rules determining its limits or character."

Our own attitude, declares Mr. Morris, toward consolidation of steam railroads which from their geographical location are presumed to be competitors is perfectly uncompromising; so uncompromising that, practically speaking, it is unenforcible in its entire purview—like the Sunday liquor law in New York. He asks if it is wise to leave on the statute books laws of such severity to

enforce competition that no attempt is made to enforce the laws, except where some particular offence is singled out for chastisement. Ever since the Northern Securities decision and the statement by the Attorney General that the government was not going to run amuck, the railroad systems and the great corporations have, he says, been living on sufferance; for all the limitation which can be found in the language of the law, there is scarcely one of them that does not possess the elements of trade restraint through combination. This sort of thing seems to Mr. Morris like the writ secured by the Duke of Alva sentencing all the people of the Netherlands to death on the heresy charge. "The Duke of Alva did not really intend to execute all the people in the Netherlands, but it was very convenient for him to have authority to make such selections as he chose without undue formality." There are few indeed of the railroad systems of the country, it is contended, that really know whether their skirts are clear of the entanglements of the law, as it has at present been construed; and it is hard to see how any large industrial company can avoid being a combination intrinsically in restraint of some other man's trade, and hence illegal. To all intent, the argument runs, the government can exercise the widest choice in its selection of victims; a condition which gives opportunity for unlimited favoritism, and tends to inject a personal element into prosecutions.

The futility of the enforced competition legislation is illustrated in rather an effective manner by the Northern Securities decision. We need not recall the facts which led up to that decision. In the language of Mr. Morris, let us see what the result was. "The Northern Pacific was the original bone of contention. The device of the Securities Company kept the Northern Pacific (and one-half of the control of the Burlington) equitably poised between Hill and Harriman; the distribution required by the dissolution of the Securities Company by the Supreme Court decision was pro rata, and resulted in leaving an absolute monopoly of three companies in Mr. Hill's hands—the Great Northern (which he started with), the Northern Pacific (with which Mr. Harriman went into the Securities Company), and the Burlington, which had been divided between the Great Northern and the Northern Pacific. The Northern Securities decision was widely heralded as a positive governmental affirmation of the principle of enforced competition—but does it appear that any important reduction in monopoly was effected thereby? Apart from the technical result

of the decision, Mr. Hill got absolute control of eight thousand miles of parallel and competing lines of which he previously shared control with Mr. Harriman. His monopoly in the Northwest was strengthened, not weakened."

But Mr. Morris is confined in no pent-up Utica. Though his theme is technically "enforced railroad competition," he evinces perfect readiness to cover the whole field of industrial activity. He recites the fact that the original purpose of the Sherman Anti-Trust Law was undoubtedly to restrain manufacturing, rather than transportation, combination, and then proceeds to show the inestimable benefits to the world of industrial combination. It is impossible for us in remarks of this length to do justice to his digression into this field. Perhaps, however, we can indicate, in some faint measure, the character of his argument by citing one or two of his facts. He even has the courage to question the oppressive influence of the "Beef Trust." Indeed, he does not hesitate to assert that, while there is no doubt that the small, independent butcher finds it harder to make a living than he would if the great packing plants were not able, by their efficient organization, to sell meat a thousand miles from where it is dressed, at the smallest fraction above cost, there is nothing in this situation to cause the consumer uneasiness. He shows this by statistics of the Bureau of Labor. Here is only one of his demonstrations: taking the average price from 1890 to 1900 as 100, he points out that in 1906 the largest purchasers (the great packers) paid 114.2 for their cattle, but sold their beef for 101.2 per cent. of the base price. A similar showing is made in the case of sheep and mutton, and of hogs and the various products of hogs. Or to put it this way, though the price of all farm products (representing non-concentration of capital) was 28.6 per cent. higher in 1906 than in 1898, the price of beefsteak (representing concentration of capital) rose only 14.2 per cent.

The street railway situation is touched upon briefly. Here we read: "It must be said in all frankness that in former days, when street railways were given franchises freely, and very little was required of them, the results to the public were extremely good, and there is reason for expressing doubt that the present tendency to scrutinize franchise privileges with extreme care and to reduce street-railway fares by franchise contracts is going to work as well. The average citizen would rather go over the whole city for five cents than be able to go over only half of it, even if he

can get over that half for three cents; and capital has little inducement to build extensions to meet the city's growth in such places as Cleveland, Detroit, or the Canadian cities and towns where much is being asked of the street railways and little is being allowed them in the way of opportunities to earn."

It is contended, too, that nobody gets any permanent profit from cut-throat competition between steam railroads, and not a little evidence is brought forward to prove this fact. For example, in the years of greatest railroad competition in this country—1870 to 1880—the shipper was never sure of his rate; he might get a low figure today and a high one tomorrow. He was always in a state of uncertainty and his business suffered accordingly. On the other hand, the pressure of competition wrought havoc with the physical conditions of the railroads. This was so notably the case in the South that Mr. Morris declares that "It was not until the great consolidations like the Southern Railway, the Atlantic Coast Line and the Seaboard Air Line got the situation well in hand that the South began to have a decent railroad service."

We cannot flatter ourselves that we have given a systematic review of Mr. Morris' thought inspiring article—we should have to extend these remarks very considerably to do that—but we trust we have made it clear that he has written something which every person genuinely interested in the material affairs of the nation can read with profit. It is impossible to cite any one phrase or paragraph as epitomizing his philosophy of the subject of which he is treating. Perhaps the nearest approach to a condensation of his ideas is the following:

"Does the wickedness of the great combinations lie in their efficiency in obtaining rebates (that is, wholesale rates) for transportation? Perhaps it did so lie, prior to the Elkins Law,—it depends largely upon one's definition of wickedness,—but rebates are essentially a competitive device, and the enforced-competition doctrine can have no quarrel with them. In what, then, do the great combinations so offend as to bring upon themselves the Sherman Anti-Trust Law, the law of enforced competition? Besides their former ability to obtain privileged transportation, they have only two other advantages over the small producer: one is efficiency—the ability to buy more advantageously, to manufacture at a less cost per unit, to sell in a wider market; the other is the power to undersell local territory and spread the cost over world-wide territory, or else charge it to profit and loss."

This is his statement of the situation, and his answer to the facts is clearly implied. Everyone may not agree with him in his conclusions, but all must admit that he has defined the issue with courage and precision.

An Important Constitutional Decision

We doubt if, in a great many years, a more important court decision has been handed down than the majority decision of the United States Circuit Court for the eastern district of Pennsylvania on September 10, with reference to the coal carrying roads. Suit had been brought by the Federal government against the anthracite carrying railroads of Pennsylvania to enforce the commodities clause of the Hepburn Act, which prohibits railroad companies from transporting in interstate commerce any article or commodity manufactured, mined or produced by them or under their authority, directly or indirectly, except such commodities as may be necessary for their use in the conduct of their business as common carriers, and except timber and its manufactured products. The case came before Judges George Gray, George M. Dallas and Joseph Buffington, and was dismissed on a vote of the first two, Judge Dallas, however, writing an independent decision. Judge Buffington, while dissenting, filed no opinion.

The full decision has not yet been published. Presumably the newspaper reports contain the real gist of the matter. Judge Gray's opinion contains this pronounced statement:

"From every point of view from which we have been able to approach the question, the unreasonableness and consequent invalidity of this so-called 'commodities clause' is apparent. It invades the rights of the state by striking down the liberty hitherto innocently enjoyed by its citizens under the laws and usages of the commonwealth, to engage in interstate commerce to the fullest extent, as to all harmless articles, whether owned or not owned by the carrier, and deprives of their property these defendants, contrary to the letter and spirit of the fifth amendment to the constitution."

Of vital interest are these words also:

"We may assume that the commerce clause of the constitution is no exception to the general doctrine, that un-

limited power has no place in American government institutions, and that there are rights of liberty and property that are secure against hostile legislative action. In the opinion of this court, the enactment in question is not a regulation of commerce, within the proper meaning of these words, as used in the commerce clause of the constitution, and therefore not within the power granted by that clause."

Judge Dallas' language is equally strong, as may be noted from the following:

"The question is not whether the carriage from state to state of coal produced by the carrier is interstate commerce, for of course it is; but whether, being a kind of commerce which is not inimical to safety, health or morals, and which, therefore, any one is entitled to pursue, 'as of right,' Congress may restrict a railroad company's interstate transportation to coal not mined or owned by it and in which it has no interest.

"Any such restriction, whatever it may be called, in its nature and effect is discriminative prohibition; and that the restrictive provision now in question was enacted not actually for the regulation of interstate commerce, but really to coerce the conformity of interstate business with a 'policy' approved by Congress, seems practically to be admitted and could not, with candor, be denied.

"No court has authority under the guise of interpretation to change the constitution for the purpose of meeting a supposed requirement of present conditions, and the covert tendency of any usurpation of any such authority would inevitably be to transform the government of enumerated powers which the constitution established into a government with all power vested in its legislative and executive branches."

Perhaps the most interesting feature of this decision is the inclination of the court to restrict the meaning of the commerce clause in the Constitution of the United States. This clause reads as follows: "The Congress shall have power to regulate commerce with foreign nations, and among the several states, and with the Indian tribes." Over these words a great dispute has arisen in recent years. The interstate commerce law is based on one interpretation of them. And lately there has been a tendency to hold

that "power to regulate commerce among the several states" means, not only power to regulate transportation among the states, but also power to regulate the production of the commodities transported. If we construe Judges Gray and Dallas aright, they are of the opinion that the tendency has gone altogether too far in this direction. Of course, it must be borne in mind that the court is passing upon a specific case (the case of the commodities clause in the Hepburn law) and that it is not intent on outlining a general theory of interpretation; it is merely interpreting the Constitution with reference to this one thing. Still; we think there is a feeling among lawyers that the decision before us reflects a very conservative attitude on the part of the Federal courts with reference to the legislation of the times dealing with the relations of government to industry, and particularly to public service corporations. This decision, if not set aside by the Supreme Court of the United States, seems likely, for this very reason, to take rank as among the most important ever handed down by American courts.



THE ELECTRICAL COMPANIES IN THE COPPER COUNTRY

From the car of an airship hovering above the Keweenaw Peninsula, that juts out into Lake Superior, a passenger would see a long arm of land, divided in the middle by a river, a lake and a canal, half denuded of its timber and surface torn here and there, in this place and in that by some eager, human activity. Even were it not for these scars upon the earth, the mounds and heaps and gullies of this rolling, jutting finger of land would suggest that nature had laid down here so many piles of valuable metal and thrown a handful of earth upon each to conceal its true character.

But the passenger upon the steamer, that slid out from the Duluth docks the night before, sees in the distance the low lying arm of the Keweenaw tongue with the wisps of smoke from smelters and shaft engines trailing northward above, with full realization that he is approaching the most wonderful copper mining country, compassed in so small an area, in all the world. Into the low-walled Portage River, the great steam vessel finally slides, like a property ship running in a groove upon a stage: into a region of red and brown and black sand, of bare and bushy, round topped hills, of reddened waters, of gawky mine shafts clinging here and there, of smoke belching stacks. And at last between two slanting walls of shore, with two towns clinging to the slope of each, the great hull noses up among other great hulls of ore steamers and nestles to a line of docks upon which there lie, piled up, ingots—red, glistening millions of copper.

Copper produced these two towns, of course,—the towns of Houghton and Hancock, squatting on the southern and northern banks, just above the yawning of the river into Portage Lake; and copper produced the opportunity for the Stone and Webster companies, one of which furnishes the region with light, the other of which, draws its miles of electric car tracks through the two towns and northward to the other copper towns of Red Jacket, Laurium,

and Wolverine, and then westward to Lake Linden, with its stamp mills and smelters. On every side is the dull red of the stamp sand, the more sombre debris of the amygdaloid ore, the gray-sided shaft houses, the rumble of ore cars on the skip-ways, the evidences of the vast mineral deposit upon which literally and metaphorically the structures and activity of a large population rest.

The geological story of this country is a tale of a vast sea, the mother of Superior and its fellows, that beat down the shores at its edges, that made for itself a bed that today is partly dry land; the tale, too, of how volcanic eruptions below this sea poured forth a mighty lava flow through this bed of broken rock, and of how part of the lava was solid and a part spongy and suitable to receive the copper deposits that were precipitated from the water. At last the tale ends with the strains that tossed the old bed into tilted stratas, the uneven ends of which were washed down by centuries more of water before the copper peninsula, high-backed, thrust its ridge into the sunlight.

The Mound Builders and the Indians knew the copper deposits; the former made copper tools, the latter had strange, superstitious notions about the region. The ancient Chippewa derived no use from their occasional finds of native copper gleaming in weird shapes in rock fissures. Naturally enough, such a thing was a concern of gods rather than of men. The Chippewa parted the bushes and went on his silent-footed way, casting a broken shadow on the forest floor.

The Jesuits—and in the lake region all that the Jesuits did not find is not worth a search—told about copper on the peninsula, before 1660,—almost two hundred years before humanity made a business of going after it. Then there was Captain Jonathan Carver, an astonishing prevaricator, who wrote with perhaps accidental truth about finding copper in 1770. His book started a London company which financed the first mining venture in the "Copper Country."

A tunnel was started in 1771. But it was started in such a place that it was a good mile of digging through sandstone to the copper bearing rock and this hopeful and hopeless digging was never finished. For seventy years the peninsula was left to the voyageurs' campfires and to the fur-traders of the Hudson Bay Company. Then along came Dr. Houghton, a young man who undoubtedly would have made a success of anything. He was a



geologist, a miner, a mayor of Detroit, a business man, and an explorer and goodness knows what else. And he opened the Copper Country.

He opened the copper country and the first mine shafted,—The Cliff, owned by the Pittsburg & Boston Company, before it had exhausted its property in 1879, paid \$22.00 for every \$1.00 invested. The peninsula was opened and a hog of one of the settlers foraging for sustenance uncovered, without a thought of the consequences, the first signs of the copper deposits that are now the Calumet & Hecla conglomerate lode.

A trip on the interurban road of the Houghton County Traction Company at least furnishes a nodding acquaintance with the region. The car takes one at the beginning through the median line of Houghton, undoubtedly as dignified and well grown a mining town as exists in the geographies. The battalions of store fronts present a clean and prosperous line upon parade. People live in their own homes a bit up the hill, and down toward the river front below begins the locality of warehouses and docks.

It was not so many years ago that none of these things were here. In 1850 the whole of Houghton County only had seven hundred inhabitants and since 1890 the town of Houghton has doubled in population. Such is the magic of the copper hills of this shore—and the other across the stretch of water of the River.

The car turns across the bridge to enter Hancock that sits upon the opposite bank, below the sharp outlines of mining structures that perching on the ridge above, are outlined against the sky, and filling gradually with passengers, climbs the slope for its northerly journey toward Laurium. The course is now along the back of the ridge with here and there a break in the new growth that lines the track, through which appear the occasional shaft houses. Stops are made at little stations and, half way to Laurium, passengers get off at the company's recreation park with its music, its picnic groves and dancing casino. The traffic to this park more than taxed the carrying capacity of the road on several occasions this summer.

There are twenty cars in the service, without those newly purchased during the writing of this article to meet the new demands of the region, and the heavy and valuable traffic is interurban—the carrying of persons between Houghton, Hancock, Laurium, Red Jacket, Lake Linden, Tamarack City and Wolverine.

The railroad was built eight years ago in 1900. Twenty-

seven miles of track have been laid. Operation is carried on under franchises whose lives last until 1930 and 1933.

When the Company went into the field it was not without a consideration of the remarkable growth of the peninsula population. From 1890 and 1900 the population of Houghton had increased nearly fifty per cent.; Hancock, Red Jacket, Laurium and the other towns even more. The population of Houghton County had risen from 35,000 to 66,000. Production of copper in the territory had gone from 45,000 to over 63,000 long tons or one hundred and forty-two million pounds. The rapid development of mining, the almost inexhaustible mineral wealth below and the necessary consequence of increasing humanity and human activity upon the surface indicated the splendid opportunity for an electric road.

There has been plentiful fulfillment of the expectations of this foresight as to the growth of the region. Houghton's population has increased from under 5000 to more than 6500; Hancock shows a still larger growth in the eight years and Laurium's population has doubled. This is sufficient to show the development of the peninsula. The world eternally demands more and more copper and this range is ready—will be ready for centuries—to increase its output. More copper mining needs more persons; more persons more public service.

The journey from Hancock to Laurium furnishes plentiful evidence to the eye to reinforce the figures in the mind. For it is a trip that is not without a stopping here and there at the little stations to take on or let off passengers who travel to and from the mine mouths. Some of these diggings are not old. Then too one does not travel far without having explained to him that the wind-mill frame structures in the brush wood and clearings are the erections of prospecting parties searching down, by the so-called diamond drilling method, with a metal tube edged with black diamonds which cuts down into the ledges bringing up a core of tell-tale rock. And there is pointed out a shaft house that stands over a hole more than a mile deep at the bottom of which after a long journey there are men at work. What if a car loaded with ore broke away at the mouth and started down the shaft! Perhaps the roar of its coming might be heard at the bottom. A cheerful time would be left to those below to think about it! The whole country is one of newness, rapid, lusty growth and romance.

Just outside of Laurium the car, after fifteen miles of cross country, turns the corner at the company's car barns and enters



that double-town region known as Calumet. Somehow there is an expectation that one is to see a sort of mining camp; it lapses into an actual picture of an urban community and when one knows that the best theatrical companies come here and sees the theatre, the main streets and the hotels, the preconception has all gone.

About the two towns of Laurium and Red Jacket, cluster towering shaft houses and between them the ore railroad runs off to Lake Linden—the place of the titanic stamp mills and smelters of the Calumet and Hecla. To the north the Houghton County Traction Company's line runs to the town of Wolverine and at the end beyond Wolverine the new four mile extension of the Company to Mohawk is under construction today.

The main line between Houghton and Calumet, nearly sixteen miles long, runs over a right of way on which the road bed is covered with stamp sand from the stamp mills thereby reducing noise and dust to a minimum. On this line there are five turnouts and cars are run on half hour schedule. Four trestles between Hancock and Calumet take the tracks across the steam railway intersections. There are car barns in Laurium and in Hancock. In Hancock and Houghton the tracks are double. The railroad employs nearly one hundred and fifty employees and it is estimated that a population of 63,000 is served.

All this region is also served by the other Stone and Webster company, the Houghton County Electric Light Company, a corporation which came under the present management in August 1902.

The main lighting and power station of this company is at Houghton near the lake traffic, fresh water and coal supply, but there is a secondary station at Lake Linden operated principally to take care of emergencies and which sells power at times to the railway company. The population served by this company is considerably over seventy thousand; more than four thousand of which are now customers of the company.

The comparison of the recent gross earnings of these two companies, the Houghton County railway and lighting properties, with the gross earnings at the beginning of the present management is interesting. In 1901 the railway just beginning its operation earned \$87,246; in 1907 it earned over \$249,000. In 1902 the lighting company earned \$168,310; in 1907 it earned approximately \$250,000.

North and south of Houghton the copper peninsula goes on

developing its growth. Even during the recent depression the miners in this country were kept employed. No one can point to any indication that the future increase in peninsula activity and population will not be even greater than that of the past. With the larger number of people the railway company will have more traffic, with the widening of the copper mining activity the addition of large lighting customers will add to the lighting company's activities. The region is one of eagerness for the tomorrow—confident, good natured.



THE HASUER LAKE AND WOLF CREEK PROJECTS

By BARRETT SMITH.*

The region of the upper Missouri River near Helena, Montana, presents exceptional opportunities for water power enterprises. Flowing abundantly in a deep bed between precipitous hills and dropping down from the mountains the river itself seems to invite development, while to the south and southwest, within easy range of high tension transmission, the greatest collection of mining properties on the continent affords a market for power. Helena, Butte and Anaconda, with their mines and smelters using enormous blocks of power where fuel is very dear, are all within the zone.

Very natural it is then to find that the situation was among the first in this country to engage the practical working interest of large capital in water power development. The work began in 1896, almost at the inception of the era of long distance transmission of electrical power, after the Federal Government, at the instance of the Helena Board of Trade, had conducted investigations and declared the Missouri River unnavigable above Great Falls, Montana. This made permissible damming of the river and the storage of its waters.

The first plant was built at Canyon Ferry, 17 miles northeast of Helena. It was completed in 1908 and has been in operation regularly since that time, at first supplying power only to Helena and vicinity. The capacity of this plant is 9000 H P, the dam being 470 feet long and 40 feet in height.

At Hauser Lake, 16 miles below Canyon Ferry and 18 miles from Helena, a second installation was completed in 1907. This original Hauser Lake development consisted of a steel frame, steel plate and masonry dam, 70 feet high and 630 feet long, with a power house of 14,000 Kw. capacity. The height of the dam was

* Of Stone & Webster Engineering Corporation.

increased several feet by the use of flash boards. The lake impounded had an area of ten square miles and was named after Ex-Governor S. T. Hauser of Montana, who has been from the first a leading figure in the projects under consideration in this article.

The power house at Hauser Lake contains five pairs of horizontal turbines, direct connected to 2400 volt Westinghouse generators having a capacity each of 2800 Kw. The transformer capacity of this power house is 18,000 Kw. and the transmission potential is 60,000 volts.

On April 16th of this year the Hauser Lake dam broke in the center with only sufficient warning to allow the operatives in the power plant, right below, to escape with their lives. In a short space the whole structure was practically engulfed, but the end sections of the dam, about 150 feet on either bank, held so that the rush of water was confined to the middle of the river and the building and equipment were only superficially damaged. The tremendous volume of water turned loose may be appreciated from the fact that at the town of Craig, 30 miles below Hauser Lake, a railroad bridge normally 25 feet above the river was submerged nearly two feet. The inhabitants of this town all escaped with their lives and took refuge in the hills. That no lives were lost here or elsewhere within range of the flood was due, in large measure, to the presence of mind and prompt action of the General Manager (M. H. Gerry, Jr.), of the Helena Power Transmission Company. He was at Helena when he was informed of the disaster by the operatives at the dam site over a telephone which they quickly improvised. First, telegrams were despatched to all points in the danger zone, one of which sent a Great Northern locomotive down the valley shrieking warnings as far as Great Falls, 70 miles distant. These most urgent precautions taken, the general manager started for the dam site and within half an hour had established his headquarters there, 18 miles away.

The recovery from the shock of the destruction of the dam was rapid. That it should be immediately rebuilt was the determination of Governor Hauser and his associates, although it appeared that the loss sustained would approach a million dollars. The load was taken up by the Canyon Ferry plant and by an auxiliary steam plant at Butte. Negotiations were shortly commenced with construction firms in the East for the reconstruction of the



dam. These culminated on July 11th in the selection of the Stone & Webster Engineering Corporation to carry out the construction on the cost plus a fixed sum basis, and on July 28th the work of rebuilding actively began.

The progressive policy of the interests managing these developments on the Missouri River was further manifest in the plans for the Wolf Creek installation, which will have a capacity nearly equal to the aggregate of the Canyon Ferry and Hauser Lake plants. Arrangements for this greater work have been carried along with the preliminaries of the Hauser Lake work, and the task will also be in the hands of the Engineering Corporation. The site is about 24 miles below Hauser Lake. The dam will be 1800 feet long and 110 feet high and 30,000 H P will be developed.

As the demand for power from the Helena, Butte and Anaconda mining industries within the range of transmission has grown, the interests holding the power rights have expanded. The Canyon Ferry plant was built by the Helena Water & Electric Power Co. In 1900 the Missouri River Power Co. was formed to develop power on a more extensive scale and to build transmission lines to Butte. Then the Helena Power Transmission Co. was formed in 1905 especially to build the Hauser Lake plant and dam. The following year these interests were consolidated in the United Missouri River Power Co. Finally, to carry out the Wolf Creek development, the Capital City Improvement Co. was organized.

The processes of mining and refining ores to which electrical power is particularly adapted, and which have caused the demand continually to outdistance the capacity of the plants on the Missouri, are very numerous. Among these uses especially to be noted are the driving of the air compressing machinery for the mine drills, the operation of the mine pumps and the operation of the concentrating machinery. Altogether, the scale upon which the consumption of power in mining operations is graded is tremendous. It may be appreciated in some degree when it is noted that a single property, the Washoe smelter at Anaconda, is equipped with 13,000 H P of motors, which are subject to an average load of 8000 H P.

The work of construction at Hauser Lake is already well started and the camp is a busy one. The most important single event yet occurring has been the location by diamond drill borings of foundation rock for the new dam at comparatively easy working depth, whereas the greatest fear had existed of holes that would

make the construction very costly. The precise type of dam to be installed is not yet decided, but the wreck of the old dam is being entirely dismantled.

Living accommodations for a considerable construction force have been built and equipped with a water supply system; scows for the pile drivers and diamond drill have been constructed, and new roads have been made and old roads remade for the transportation of steam shovels and locomotives. An electric power plant and lighting system is under construction, and arc and incandescent lighting will be supplied for night work. The construction equipment on the ground includes rock crushing and cement plants, five sets of derricks with hoisting engines and boilers, a 40 ton traction steam shovel and six car-loads of lesser plant. Shipment has been ordered of a traction engine with six steel trucks, two narrow gauge locomotives and 50 dump-cars. An order of two million feet of timber for the cofferdam is being delivered at East Helena to be floated down to the dam site, while an initial order for cement, amounting to one hundred thousand barrels, has been given.

At Wolf Creek the way is being prepared for construction by the building of a spur from the tracks of the Great Northern railroad to the site of the dam.



LIGHT VS. HEAVY CARS FOR STREET RAILWAY SERVICE

By L. H. PARKER.*

Some electric railways, having both city and suburban service with stops averaging four to five per mile, have been using, during the past year or two, semi-convertible cars all the year around. These cars weighing from 28 to 30 tons light, have generally supplanted the double equipment of cars, i. e., about a 25 ft. box car for winter and a 10 to 12 bench open car for summer service. These latter cars only weigh from 12 to 13 tons light.

Consumption of Energy.

Where stops average about four to five per mile and the grades are few and light, the semi-convertible cars require an average of about 5 kilowatt hours per car mile. The 25 ft. box and 12 bench open cars consume about half this amount of energy or approximately 2 1-2 kilowatt hours per car mile. These figures have been confirmed by actual test. The energy required for the propulsion of electric cars on mixed city and suburban service, where stops vary from three to ten per mile, consists for the greater part of that required to accelerate the cars from stop to full or partial speed. The power required during the accelerating period is generally from three to five times that required to propel the car at full speed. Where stops are less than one or two per mile the energy consumption is much reduced.

In order to determine whether the straight semi-convertible equipment costs more and is more expensive to operate than a mixed equipment of box and open cars, the following comparison has been made of the investments and yearly costs of power, wages, maintenance, depreciation and fixed charges.

It is the belief of many that the heavy semi-convertible car is too expensive to operate on mixed city and suburban service for the

*Of Stone & Webster Engineering Corporation.

reason that its greater capacity is of no particular value, except during the rush hours; i. e., for about four hours out of the eighteen hours of daily service. The remainder of the time, viz., fourteen hours, the lighter cars, consuming much less energy than the semi-convertibles, will handle the business just as well as the heavier cars. This is true of most all city service, with the possible exception of some of the main surface lines in New York City, where the cars are completely filled at all hours of the day.

INVESTMENT.

Equipment consisting of 50 semi-convertible cars for all-year-round service. Each car seats 52 and can carry 100 with standing load.		Equipment consisting of 50 summer open cars (12 bench) and 72-25 ft. body closed cars seating 34 and carrying 70 passengers incl. standing load.	
Power Sta. 2,500 KW @ \$150.	\$375,000	Power Sta. 2,000 Kw @ \$150	\$300,000
Car House 30,000 sq. ft. @ 2.50	75,000	Car Houses 1-30,000 sq. ft. @ 2.50	75,000
		1-25,000 sq. ft. @ 1.50	37,500
Cars 50-semi-convertible cars completely equipped with 2-75 HP or 4-40 HP motors, heaters, pneumatic door opening device, air brakes, etc., @ \$8,000.	400,000	Cars 50-12-bench open cars, ea. equipped with 2-30 HP motors @ \$2,500 ea.	125,000
		72-25 ft. body box cars, ea. equipped with 2-30 HP motors @ \$3,500 ea.	252,000
Total	\$850,000	Total	\$789,500

Yearly Cost of Power, Wages, Maintenance, Depreciation and Fixed Charges.

Power Cost 9,125,000 KWH at Cars @ 1.5c per KWH.	\$136,875	Power Cost 4,790,625 KWH at cars @ 2c. per KWH.	\$95,812
Maintenance of Cars & Elec. Equip. 1,825,000 car ml. @ 1c.	18,250	Maintenance of Cars & Elec. Equip. 1,916,250 car ml. @ 1.5c.	28,743
Maintenance of Power Plant 2,500KW. @ \$2	5,000	Maintenance of Power Plant 2,000 KW. @ \$2	4,000
Wages—Conductors and Motormen 1,825,000 car ml. @ 4½c.	82,155	Wages—Conductors and Motormen 1,916,250 car ml. @ 5c	95,812
Depreciation An average of 5% on all items of above investment.	42,500	Depreciation An average of 5% on all items of above investment.	39,475
Fixed Charges 7% of Investment	59,500	Fixed Charges 7% of Investment	55,265
Total	\$344,280	Total	\$319,107
		Difference	25,173
		Total	\$344,280

Number of Cars.

In the foregoing comparison we have considered a road requiring 50 semi-convertible cars for all-year-round service. Each of these cars will seat 52 passengers and stand an additional load of about 48, making a total load of approximately 100. The 25 ft. box cars will seat about 34 passengers and accommodate approximately 70 passengers, seated and standing load. During the rush hours of traffic, therefore, it is necessary to increase the number of 25 ft. box cars over the number required of the semi-convertibles in the ratio of 100 to 70. Therefore, seventy-two 25 ft. box cars would be required. For the summer service fifty 12 bench open cars are figured on. During the rush hours in summer the open car equipment can be supplemented by some of the closed box cars when necessary. The 12 bench open car will accommodate, seated and standing about the same number of passengers as the semi-convertible car which we are considering. It is hardly probable that box cars would be used during the rush hours in the summer time to any great extent.

Mileage.

For the semi-convertible equipment an average of 100 miles per day per car has been figured on; this gives a total of 1,825,000 car miles per annum. For the mixed box and open car equipment we have figured on a 5 per cent. increase on the above mileage, giving a total of 1,916,250 car miles. These figures are determined by considering that during 14 hours of the 18 of daily service the mixed equipment would have the same mileage as the semi-convertible equipment, as the same headway of cars would be maintained for either equipment. During the four rush hours, or about 22 per cent. of the total time a 44 per cent. increase of mileage is required, which is equivalent to approximately 10 per cent. increase for all the time; but as this increase is only required during half the year, i. e., the winter season, it is fair to assume an annual increase of about 5 per cent. for the mixed equipment over that required for the straight semi-convertible equipment.

Cost of Power.

As mentioned above, we have assumed 5 Kwh. per car mile for the semi-convertible equipment, which gives a total yearly output of 9,125,000 Kwh. at the cars. The cost per Kwh. would be approximately 1.5c. at cars.

The energy consumption for the mixed equipment is approxi-

mately 2.5 Kwh. per car mile. For the sake of comparison, we are assuming that the 12 bench open car will consume the same average amount of energy as the 25 ft. box car for the same service. This is not quite true as there is a slight difference in favor of the open car. On account of the poorer load factor of the power system for the mixed equipment we have assumed a cost of 2c. per Kwh. at the cars.

Maintenance of Cars and Electric Equipment.

For the semi-convertible cars we have assumed 1c. per car mile for maintenance; while for the mixed equipment we have assumed 1.5c. per car mile. This is because of the lighter construction and the fact that for six months of the year the cars of the mixed equipment are deteriorating in storage and not running-up any mileage.

Capacity and Maintenance of Power Plant.

For the semi-convertible equipment we have assumed an average of 50 Kw. per car as the power demand when all cars are in service. This would give 2500 Kw. as the rated capacity of the power station.

For the mixed equipment we have assumed approximately 25 Kw. per car, giving a power station capacity of 1800 Kw. For the sake of comparison we have taken this as 2000 Kw.

Maintenance of power plant we have taken at \$2.00 per Kw. of capacity in each case.

Wages—Conductors and Motormen.

We have assumed a cost of 4 1-2c. per car mile for this item in the case of the semi-convertible equipment; while for the mixed equipment it is taken at 5c. per car mile; the increase being due to the necessity of having a larger *extra* list of motormen and conductors for the mixed equipment during the rush hours.

Car Houses.

For the semi-convertible equipment we have assumed that an operating car house of 30,000 sq. ft. area at \$2.50 per sq. ft. would be required.

For the mixed equipment an operating car house of this capacity would be required and a storage car house of about 25,000 sq. ft. at \$1.50 per sq. ft. would also be found necessary.

Cost of Rolling Stock.

The semi-convertible cars are taken at \$8,000 each completely

equipped; the 12 bench open cars at \$2500 each and the 25 ft. body box cars at \$3500 each. While these are round figures, they are not far from today's actual market prices.

Depreciation.

We consider it fair to assume an average of 5 per cent. on all items of the investment which we have considered. The power station building and car houses would have depreciation nearer 2 per cent., while the motors and car bodies would run nearer 8 to 10 per cent.

Fixed Charges.

Fixed charges have been taken at 7 per cent. on the investments made up as follows:

Interest on bonds covering investment.....	5 1-2 per cent.
Taxes and insurance	1 1-2 per cent.
<hr/>	
Total fixed charges.....	7 per cent.

Gearing.

The motors of the semi-convertible cars considered in this comparison are geared to a maximum speed, on level track with 500 volts at the car, of approximately 22 miles per hour, and the motors of the box and open cars considered are geared to about the same maximum speed.

Conclusions.

The difference in the cost of power, wages, maintenance, depreciation and fixed charges, as shown in the above table, is found to be \$25,173 in favor of the mixed equipment.

There would be a substantial reduction in track maintenance, where comparatively light cars are used, which is not figured on in the above comparison.

In these days when some managers are complaining about increased cost of operation, and in many cases are talking seriously of increasing fares, it might be well to consider the saving that can be effected by the use of lighter cars.

THE PROMOTER AN OPTIMIST

By W. H. BLOOD, JR.

In these days of financial depression and dullness, it is well to pause for a moment to investigate the causes which have brought some undertakings either into bankruptcy or perilously near it.

There are many enterprises which should never have been started, and had it not been for the promoter they would not have been. The promoter sees an opportunity, a possibility, and by painting it in glowing colors is quite sure to find someone who will become interested in it. The prospectus is made to show a profit. The margin between success and failure, however, is oftentimes very narrow. The earnings of an interurban railroad may be estimated at \$5 per capita; it earns when completed \$4; the difference is only \$1; but, on the other hand, it is 20 per cent and may easily turn a proposition which appears profitable on paper to one which in realization is a complete failure. A road which is run on the basis of one ride for five cents may be operated at a loss, while a six-cent fare might be sufficient to earn a dividend.

A water power which has been developed without consideration of the market, or a market contracted for with insufficient water, is equally bad for the company when the interest on the bonds comes due. The commercial side of the proposition should have had careful study, and the engineers should have been advised in regard to the flow of the river in its driest month. Very likely, neither of these matters received due consideration. The statements of the promoter are too often accepted as facts by underwriters, by bond houses, and by investors, and a thorough expert examination is not insisted on until money has been invested and the enterprise found to be unprofitable. Then when it is too late, men of experience are called in to see what can be saved from the wreck.

The promoter is an optimist; he must needs be. He expects that his statements will be discounted and he is consequently forced

to prepare in advance for the inevitable scaling down. He has to exaggerate; it is part of his profession. Exaggerations to him are not lies; they are possibilities which he hopes will be realized. Highly colored estimates which he presents and which remain uncontradicted soon become actualities, and he thereafter gives them out as facts and regards them as already accomplished. After he has told the same story some three or four times, he actually believes it himself and proceeds to convince others of its plausibility.

It is not uncommon for the promoter to say, "Our line earns \$100,000 a year gross, etc.," when, as a matter of fact, the road is all on paper and the construction not even started, but to the promoter it is already built and earning the amount which his prospectus claims.

Most promoters have exaggerated ideas of the profits of public service corporations. They talk about "handsome earnings," "splendid profits," and generally lay great stress on the enormous value that the franchise will have in years to come. These ideas are distorted and the promulgation of such doctrines is dangerous. Investors are told that as the city grows the franchise will be of enormous value, and the general public, composed of these same investors and others who have been educated to believe that the city is giving away its birthright, soon openly assert that the franchise is worth hundreds of thousands of dollars. A day of reckoning, however, sooner or later comes and then it is found that the franchise is simply a right to do business and has no intrinsic value.

The promoter of a competing lighting plant for a good sized city asserts that "by cutting under the established rate of ten cents per Kwh. the new company would reap a very handsome profit." In making such a statement as this he probably does not intend to be dishonest but really does not know what he is talking about. An average rate of ten cents for all current sold would be profitable, but to get such an average means that some customers must be charged twenty-five cents per Kwh. to make up for others whose rate is three or four cents per Kwh. Load factors, hours of maximum demand, etc., are all Greek to the promoter; he feels morally sure that a ten cent rate, whatever that may mean, is a bonanza and ought to be jumped at.

A favorite, and often the only, argument for building an inter-urban electric road is that the "farmers all along the line would appreciate it and would patronize it liberally"; but whether it re-

quires a population of 100 or 1000 per mile to make the road pay is not known by the ordinary promoter.

A promoter actually wrote in good faith and suggested the building of an interurban railway twenty-one miles long and across a mountain range to connect two towns, one of 659 and the other of 402 people. He was sure of its financial success for he says,—“It would make one of the best paying roads that could be built anywhere.”

A larger but no less foolish proposition was the suggestion to build an interurban electric road between two western cities a distance of some 2500 miles. The crossing of the Rocky Mountains and the building of innumerable bridges were matters of secondary importance to the promoter, and all he knew was that, in a general way, “such a road ought to pay.”

Water power propositions are seldom prepared with any degree of accuracy; the power is nearly always overrated and the cost underestimated. If one takes, as a rule, the promoter's figure of the power which he claims is available and divides it by two and then doubles the estimated cost he will get a pretty close approximation of the true facts.

The promoter generally is able to figure out from twenty to thirty per cent profit in his enterprise. Those who furnish the money hope to realize from ten to fifteen, and if through a series of years the business yields seven or eight per cent it is called a successful undertaking and thanks are due to the promoter for his optimism which made the development possible. On the other hand, he may be figuring on such a close margin that after the inevitable scaling down takes place there remains no profit at all.

Optimism is a good thing; idealists help in the progress of the world; hard-headed and honest business men, however, are needed to hold the dreamers in hand and to differentiate between fairy tales and facts.

A WORD OR TWO ON PUBLICITY

I.

Publicity is worth talking about. It is worth talking about because its value is worth considering. But it is worth talking about a thousand times more because few enough persons have any very distinct idea of what publicity is. Publicity in the minds of nine out of ten executives who use it in their business and in ninety nine out of a hundred of those who do not is a vague means to a vague end. To most men publicity is a good deal like immortality, they do not know anything about it but are perfectly sure that they know it all. Men who will not risk an opinion on anything susceptible of proof will discourse with a learned frown and an analytical tongue upon publicity.

Seldom will such a discourse pour forth more than a minute without disclosing the fact that the talker has already confused publicity with advertising. Now advertising as the term is used means a printed appeal to a possible buyer. Advertising is properly a means to a sale or disposal of something. Advertising invites someone to pay for something. Advertising is preliminary to a business transaction.

Publicity is nothing of the sort. As the term is used publicity has nothing to do with a business transaction. Publicity is merely the written words of an individual or corporation given a wide display and intended to convey to the minds of a large number of persons the same thoughts that the individual or the officer of the corporation would express to one of these persons if he had that one person in his private office to ask for his co-operation or to inform him upon a point of mutual interest.

Certain kinds of business activity interest a large number of persons who are in no way directly connected with the business. This interest, unfortunately, is often like an interest in the life on Mars, provided with meagre facts upon which to base an opinion. But the opinion is there just the same. Sometimes opinion is held by those

who are properly interested in an individual or corporation—for instance it is proper for interest and opinion to be held by persons who are going into a voting booth to cast a ballot for a particular individual who is candidate for mayor or governor or president. Or it is proper for a citizen to have an interest and opinion concerning a public service company. Some persons may deny this. But the interest and opinion of the public will be present just the same. The denial has no virtue to change the situation. There was a time when a man in charge of a public service corporation who said "The public be damned" would have been called a rascal. To-day such a man would be called a fool.

The use of publicity as it applies to public service corporations is first a pretty wholesome and beneficial admission that the public have an interest in public service and that it ought to have an interest and that the public service company is very glad that the public does have an interest. And the main function of publicity is to help that interest to be calm, and free from spite, and intelligent, just as it surely would be, if the persons who were interested were not making ignorant judgments on some unexplained subject.

Another strange conception about publicity that seems to be firmly rooted in the minds of many executives is that publicity is something to use in an emergency, and then only. Not until public opinion is running in a torrent in the wrong direction, do most executives call out for someone to come and build a dam. Many an able railroad president has uttered this appeal to someone skilled in publicity. There is a great halloa for publicity at the very moment when publicity can, in the nature of the situation, do the least good. It is far easier and saves a lot of trouble to explain for example, that steam railroad rates are just and equitable, before some heated legislative session, following public opinion which in the particular case may be ignorant, has declared that they are not. Afterward, even the truth about rates is hard swallowing to a public who have committed themselves to a different and erroneous opinion. One use of publicity in time, saves nine.

Consider further, that when public opinion has already made itself felt to the detriment of some public service corporation, any attempt on the part of the corporation to mend the situation by publicity is hampered by the care that must be taken not to appear to threaten angrily or raise the least suspicion of a wail of protest. From every point of view publicity is a dignified, honest preventive but not one-half so dignified and unaffected when used as a cura-

tive. Yet it is almost never that corporation managers think of this until public opinion has galloped off and something has smashed. The truth of the matter is, that public service corporations and the public ought to understand each, not only after there has been a misunderstanding, but also before there has been a misunderstanding, not part of the time but all the time. If one will stop to think of it there has been in the United States too much desire to be friendly with officials and not one-half enough disposition to be on an open, square, fair relationship with the people who elect them.

This does not mean constant publicity. It only means constant watchfulness for signs of a misunderstanding which publicity may avert. It does not mean grovelling to the public, nor threatening the public nor pulling the wool across the public's eyes. Grovelling gains no respect, riding rough shod loses good will, and the slightest deviation from a square statement that will stand through thick and thin, is not only a deviation from good ethics but also from good policy.

Publicity is not the diplomacy of the old school. Publicity is the diplomacy of John Hay. Some one said of Hay that he was no diplomat. "All he did was to know what he wanted, then ask for it." Usually he got it. Hay was truthful, forceful and simple. All publicity should so be.

The day when the business of public service corporations was transacted in whispers has gone. Most of the whispering was unnecessary anyway. Publicity did not belong to that regime. It belongs to a new school of public service management—one that believes the interests of the corporation and the public are inseparably bound together and is willing to make the public believe that this is true.

NOTE: Two more articles will mention briefly the purposes and methods of publicity.

DRYING OUT ELECTRICAL MACHINERY AFTER BEING ENTIRELY SUBMERGED IN MUDDY WATER FOR SEVERAL DAYS

By D. VALENTINE.*

Fortunately the opportunity does not often present itself, whereby the employees of a power plant can be put through a thorough course of training to fit them out as specialists in the above line of work. Nevertheless such an opportunity did present itself to the employees of the Dallas Electric Light & Power Company after the memorable flood of May 25th, 1908, when all of the electrical machinery, excepting the generating end of the two 1500 Kw. Curtis turbines, was entirely submerged in muddy water.

The water began to recede about 5 P. M., after having attained a height of about 53 feet (at the time of writing the height of the river is 4.6 feet—note the contrast). During the time the water was at its height preparation and planning were all that could be done. It was decided, however, to bring down from the sub-station a 25 Kw. exciter, which was brought to the plant on a raft constructed of poles and planks, on which it was left standing until the water had receded sufficiently to admit of its being floated into the plant. In the meantime men, stationed at various points of vantage with water hose, were instructed to wash off the machinery as soon as it appeared, and to keep on washing until all the water had receded and all the mud was washed out of the armatures and fields. This done we had the machinery practically free from mud, but all thoroughly soaked with water. We were now confronted with the problem of drying out all the electrical apparatus. As soon as the water had receded from the turbine room floor, on which it had attained a depth of five feet, two inches, the exciter mentioned above was temporarily located and connected up. In the meantime a gang of men had been busy in the boiler room clearing away drift wood, etc., and getting up steam. After this was done the turbines were started up running non-condensing, as

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all the auxiliaries were soaked with water and some of them were still under water.

Attention was next given to a Kw. steam driven exciter, which was the only D. C. machine from which we could hope to get any current for some time. The commutator was partly dried by blow torches, but not completely dried out by any means, as we still had a dead ground through the armature. We started her up on a short circuit however and, after finding she would work all right at low voltage, we put the armatures or stators of the two circulating pump induction motors and the two hot well pump motors in series with the exciter armature and in parallel with each other. This gave us sufficient current to heat up the armature to a temperature of 200 degrees F., so that in 48 hours these motors were sufficiently dry to put into service, thus leaving the steam driven exciter available for use in drying out the other exciters, which were motor driven and, hence, suffered more from being under water. D. C. current was sent through the armatures of the motor end of these exciters until they were dry, when they were started up and the armature leads on the D. C. end short circuited, and the machines were left running in this condition until they were dried sufficiently to put on the line. During the time this work was going on, the water was still receding and opportunity for quick and continuous work rapidly presented itself.

As we still had only 25 Kw. D. C. current for drying purposes, other and more drastic measures had to be resorted to. With this end in view the manager of the lighting company got in touch with the manager of the gas company, who had a main a quarter of a mile away, and made arrangements with him to run a 1 1/4 inch main down to the plant. This was done in a hurry and proved to be our main support. After we got the gas, special burners were designed for each particular duty. A list of these burners is given below and they are shown in the accompanying photograph.

No. 1 is the burner used on end of commutator of M. G. machine. No. 2 is the burner used for drying M. G. fields. No. 3 is the one used for drying the fields of the 800 D. C. machine, while No. 4 is the one used to dry out the commutator of the 800 D. C. machine. No. 5 is a burner made of 3 inch pipe and used for drying some of the stators of small motors.

All burners are drilled on one side only with 1-16 inch holes, spaced one inch apart, except No. 5, which is drilled all round, same size drill and spacing.

All of the fields were taken off the two 500 M. G. sets and the 800 D. C. steam driven set. The spools were taken off the magnets and stacked up, those of the M. G. set being rectangular in form, and sixteen in number were built up four stacks, four in each stack. Inside the lower spool of each stack was placed a burner made from 1-2 inch pipe and drilled with 1-16 inch holes 1 inch apart, the burner itself being 12 inches by 16 inches, the same shape as the inside of the spool, leaving about 1 1-2 inches clear all the way round. The spools of the 800 Kw. being fourteen in number and cylindrical in form, were stacked four and five high, and a circular burner 12 inches in diameter placed in the lower spool of each coil. The top of each stack was then covered with sheet iron. This made the most practical and the safest method of drying out the field spools. All of the above had been under water several days and were thoroughly soaked, yet with the method above mentioned they all tested perfectly dry after being heated only 24 hours. While this was going on other burners were being made for drying the commutators of the above mentioned machines.

These burners were made in the form of a horse shoe, the opening being sufficiently large to pass over the shaft, and the diameter of the burner from center to center of jets was such as to bring the flame right under the commutator for its entire circumference, except at the opening that was left to slip over the shaft. On the 800 Kw. machine the burner ring being vertical allowed the flames to shoot horizontally into the spider and as close as possible to the under side of the commutator. Half of the bolts were taken from the keeper ring to allow the escape of steam and the burners were lighted and the engine revolved as slowly as possible. The burner being stationary, this was sufficient to heat the commutator to 200 degrees F. After running this way for several days the armature leads were short circuited and the machine run at low voltage and 150 per cent full load current for several weeks without any apparent results. When at the end of this time, notwithstanding the intense heat we had maintained on the commutator for so long, we still had a dead ground on the armature, we were satisfied that the trouble was in the commutator, and we decided to take off the keeper rings and entirely strip the commutator bars. This we did and, to our surprise, the moulded micanite was found to be like wet pulp. After taking all of this out our machine showed perfectly clear of ground. The insulation

was placed on the cylinders to dry, and after the insulation was put back and the keeper rings were in place the machine still "rang clear," but the commutator was slightly out of round. A few hours turning and the machine was put on the line on the first day of the Elk's Convention and on several occasions she was called upon for 50 per cent. overload, which she carried without a spark.

A 30 Kw. turbo exciter was loaned us by the General Electric Company and used to send current through the armature and fields of the 800 Kw. alternator, which was dried out by this means, and our 25 Kw. exciter was used to furnish current for drying the armatures and fields of the two 600 Kw. alternators. The A. C. ends of the two motor generators were dried out by passing a current of 125 per cent. full load D. C. through the armature and fields. While this was being done the D. C. armature was encircled with street car heaters and the gas jet was playing on the commutators. When the A. C. end was sufficiently dry the machines were started up and the drying of the D. C. end was completed by short circuiting the leads and running them on a short circuit until fit for the line.

For drying out the coils of the tub transformers, temporary baking ovens were constructed out of ship-lap boards and were six inches by six inches by four inches. In these boxes steam coils were placed. The coils were made of 1 1/4 inch pipe, U bends being used, each coil being four feet six inches by four feet six inches. One steam coil was laid on the floor and on this were laid four primary coils, then another steam coil, then a layer of four secondary coils, then another steam coil, making a regular sandwich; finally, covering over the top the steam passing through the coils was just sufficient to keep out the water of condensation and the oven was a complete success. We found it necessary, however, to raise the outer insulation on the coils at several points to allow the escape of steam, which came out as if from the spout of a tea-kettle when boiling. One 85 Kw. Bullock motor after resisting all other methods, was finally put in an oven, the rotor being removed and a piece of 18 inch pipe 24 inches long suspended in place of the rotor. Inside of this pipe was placed one of the rectangular burners that had been used for drying fields; the burner was lighted and a cover put on the oven. The pipe was merely to protect the coils from the flames and get a better diffusion of the heat. The temperature of this oven was 230 degrees and the motor was dried in 48 hours. Still another of these ovens was used for drying out

the compensators and the fields of the two Kw. belted exciters. Six C. R. regulators were dried out with current from a 35 Kw. exciter.

Among many other things we found out that if we had stripped the commutator of the 800 D. C. machine, when we first commenced to dry out, we should have saved half of the time. The same may be said of all D. C. machines. We also found that by taking off the outer insulation, leaving the insulated wire exposed, small field coils that had resisted the drying process were afterwards dried out in 48 hours. The resistance of each piece of machinery was tested daily with volt meter, and while the machines showed a dead ground, it was still impossible to light a two candle power lamp with 600 volt circuit, showing that the ground was made up of a very small leakage covering a large area. Even when the 600 volt current was applied directly to the commutator, only the merest spark was visible, notwithstanding the fact that the volt meter would show full voltage through armature to ground. This seemed to show that, with a leakage due to general moisture, the tendency to jump to ground at any particular point was very remote. It would at first seem that with the very slightest leakage at every point in the armature, it would finally sum up to one large leakage, but an ammeter placed in circuit failed to show any deflection whatever. Nevertheless I believe that if the machines are not properly dried before putting in service, the life of the machine would be dependent upon the result of a race between the destruction of the insulation by the continuous jumping to ground of the very small amount of current all over the wetted surface and the natural drying out of the machine before this destruction is complete. In any event the insulation would be very materially weakened and might break down under the slightest provocation.

Below is a complete list of the electrical machinery that was submerged, all of which has been thoroughly dried and is again in constant service:

One	800	K. W. D. C. generator
"	800	" A. C. "
Two	600	" " "
"	500	" M. G. sets
One	85	" M. D. exciter
"	85	Bullock motor
"	85	Westinghouse exciter M. D.
"	35	Exciter, M. D.

- " 25 Steam driven exciter
- Two 85 G. E. induction motors on circulating pumps
- " 7 1-2 H P motors driving hot well pumps
- One 20 H P Westinghouse motor on deep well pumps
- " 85 " motor that was not in service
- Two 20 " motors that were not in service
- " 25 K W belted exciters
- One 10 H P motor not in service

And all compensators for the above motors

Eight 100 light arc transformers

Six C. R. regulators, each 100 amp. capacity

Eight switchboard panels for arc transformers

All steam engines and pumps in the plant were entirely submerged.

"POWER STATION MAINTENANCE"

The increasing number of break-downs of power station apparatus throughout the country recently is a matter which has caused considerable comment. The failures apparently are not confined to any form of station apparatus, and are therefore not due to inherent defects in the same. Consequently, those interested are led to believe that the number and seriousness of such failures would be greatly reduced by a systematic inspection of the machinery by the station operatives, followed by regularly scheduled repairs. The above conditions indicate a somewhat haphazard method of operation, which is bound to have a considerable effect on the costs of the two large items of fuel and labor.

It is believed that there should be in all plants two classes of inspection going on at all times; namely, a daily inspection, which will consist of a certain amount of cleaning combined with surface inspection, and a repair and maintenance inspection devoted to such parts as it is unnecessary or unwise to overhaul daily. It is also believed that both forms of inspection should be done as far as possible according to a definite, prearranged schedule regardless of whether the machinery apparently needs it or not.

The details of the repairs under the "Repair Schedule" should be completely noted in a record by itself, and the daily inspection, together with a general statement of the repairs in connection with the same, should be noted in the "Remarks" space of the daily log sheet.

It is believed that by regularly opening-up and repairing all pieces of apparatus the cost of maintenance will be decreased and the reliability of the plant will be increased. Such work as this, by its very nature, should not be considered as emergency work. When it is done in emergency the haste necessary to get the apparatus back into service causes indifferent or temporary work, which generally has to be done over, and as a result nearly always means the calling in of expensive outside assistance. For the benefit of station managers and operatives, an outline is given of

various classes of maintenance work and some suggestions as to the handling of the same.

DAILY CLEANING.

It stands to reason that the statement that "few ill-kept or dirty plants operate economically" is a true one. When it is said that "power plants should be clean," it is not meant that they should be cleaned up once or twice a month, but then and there by the constant attention of the operatives, who when they see a dirty spot or some evidence of disorder should set the matter right immediately. When the night oiler has too much to attend to with his oiling, such work as cleaning floors and walls can well be done by some laborer especially hired for the purpose; but all other cleaning, particularly of the machinery, should be done by no one less in degree than an oiler. One reason for desiring that these men should clean all machinery, is that they should have sufficient knowledge of it to note the beginning of any trouble, so that it can be cured before it has become more than a beginning. It is also a fact often noted, that if the operatives know they are expected to keep the station clean themselves the cleaning process is going on at all times, as it means less total and hard work to them; it further results in a rivalry between different watches, which holds each to better work.

DAILY INSPECTION.

This work should be confined to those parts of the machinery which may be called vital, and which might fail suddenly and without special warning. The following is a partial list of details to be examined daily:—

Engine and Turbine Safety Stop Valves and Connections:

These should not only be examined daily, but the unit should also always be shut down by these devices after the load is off, to insure that they have sufficient use to keep them in free working order.

Governors:

Governors should be examined for undue friction and looseness. The various working parts should be sufficiently scrutinized to be sure that gummed oil and dust or grit are not accumulating. The security of all nuts, bolts or pins should be examined into. Dash pots should be watched carefully, so as to be sure that the oil is of sufficient quantity and quality for the proper duty of that

governor. A disarrangement of the dash pot is, in most cases, a cause for poor regulation in a machine which has otherwise been good in this respect.

Oiling Devices:

Particular care should be given daily to the oiling devices and piping, to insure constant and free working at the rate required. This covers the main system and pumps, as well as the machine devices. The "Repair Schedule" should cover the occasional taking down and blowing out with steam.

Step-bearing Pressure System:

This includes the piping, valves, pumps and regulating devices.

Water Column Try Cocks:

These should be tried at least four times during any watch, and the water column blown once a watch to clear any sediment from it, or from the water pipe leading to it.

Any repairs required as the result of such daily examinations should be made at once, if possible before the machine goes into service. In any event, all such matters should be noted in the daily log sheet and attended to promptly, with the details of such attendance noted in the "Maintenance Log."

MAINTENANCE SCHEDULE.

It is intended by this schedule that all pieces of machinery in the station shall have definite dates, at suitable intervals, on which they shall be opened up, inspected, adjusted and, where necessary, repaired. It is expected that by following this method practically all emergency repairs will be avoided, that such repairs as are made will be done more permanently and satisfactorily, that the operating force will be used almost entirely for such work, and that the cost of maintenance will be reduced. As a result the operating force will become more efficient, due to their more intimate knowledge of the machinery and its requirements.

It may be well here to point out the desirability, in engaging engineers, of trying to get engineers having the experience necessary for using correctly at least a chisel, file and pipe fitter's tools. To do this they will require the equivalent of machine shop experience as machinists. It is also desirable, where possible, to obtain oilers who have had experience as machinists' helpers. The following is a partial list for incorporation into the "Maintenance Schedule":—

Turbines:

The economy of a steam turbine depends largely upon the proper adjustment of the clearances between the revolving and stationary blades, and it is good practice to examine these clearances once a month to see if any change in adjustment has taken place. All bearings, as well as the nozzles and buckets, should be examined every three months. A change in the form of nozzles or buckets has a marked effect upon the economy, and it is important that they be examined at regular intervals to be certain that there has been no mechanical injury, or that they have not become cut or eroded by the action of the steam.

The generator should be carefully blown out every day with compressed air, and once every week it should receive a most thorough and careful cleaning by hand.

Engine:

At least once in three months the heads of the cylinders and valve chests should be removed, cylinder and piston scrutinized, and the valves pulled out and examined. Some engines will require this treatment more frequently than others, and the time should be suited to the particular engine. Indicator cards should be taken once a month. All pin connection and shaft bearings should be gone over once a month, and it is advisable at this time to blow out the oil piping with steam.

Condensers:

All working parts should be inspected about once a month. Special attention should be paid to the pump valves to see that they are all in place, and that the studs, nuts and guards are securely fastened. The piping connections should always be under surveillance to be certain that no leaks are present. It is enough to ask of a condenser that it remove the air and gases from the water and steam without having to overcome leaks.

Boilers:

The inside of the tubes should be scheduled for cleaning at such intervals that no scale thicker than 1-32 inch shall be formed. This provision is imperative. Attention should also be given to the rear circulating tubes. The outside of the tubes in general should be dusted about once in two weeks, depending on the character of the fuel and its tendency to form dust and soot. At such times soot and dirt should be cleaned out of the middle pass and back end of the boiler, and the baffle bricks examined to see that they are whole and in proper position. It will be pertinent to

remark here that tubes cannot be properly cleaned from the outside of the boiler. The men must go inside the boiler, and, if necessary, they should be provided with goggles and sponge mouth-pieces. The furnace and bars should be thoroughly cleaned out once a month.

Auxillaries:

Practically the same remarks made regarding engines and condensers apply to this subject. In the case of mechanical cooling towers, the distributing arm shaft should be examined monthly to insure that it is free, and all holes in the arms should be opened up.

It may be noted from the above that it is not considered good operating practice to allow the maintenance of the apparatus to go until it will not operate without repairs. It is also believed that it should be insisted that the chief engineer make the final inspection *in person* before the apparatus is closed up.

MAINTENANCE LOG BOOK.

A "Log Book" for the entrance of maintenance data should be kept. This book can have the form of an ordinary journal or record book used in book-keeping. A certain number of pages should be set aside for each piece of apparatus, and all schedule inspections and repairs noted on one side and all repairs out of schedule noted on the other. These notes should describe the nature of the trouble, the extent of the repairs, the time taken for repairs and the after results.

For example:

- October 20, 1907. Examined clearances No. 1 turbine as per schedule. Found them to be 30-1000, as called for in design.
- October 30, 1907. Overhauled connecting rod pins of No. 1 engine as per schedule. Found pins and brasses smooth. Set up both keys 1-32 in. Engine ran on load tonight without trouble.
- October 31, 1907. Key of No. 2 engine h. p. crank pin loosened up to-night. Transferred load to No. 1 engine at 7.30 P. M. and set key back giving it 1-32 in. more set. Started up engine again at 8 P. M. and ran balance of night without further trouble.

November 5, 1907. Shut down boiler No. 5 at 8 P. M. November 1st for scheduled internal cleaning. Started cleaning yesterday A. M., turbinized the tubes, bored out back circulating tubes, chipped scale off back headers and washed out. Put boiler back into service at 5 P. M. tonight. No outside men used.

November 8, 1907. Shut down boiler No. 7 at 8 P. M., November 5th, for scheduled external cleaning. Dusted tubes, cleaned out soot from middle and back pass. Replaced three baffle bricks in first baffle that were burned out. Cleaned out grates, put in two new bars, chipped slag off furnace walls, repaired bridge wall and door arches. Boiler went into service again at 5 P. M., tonight.

The expression "O. K." on the "Log Sheet" in the "Maintenance Log" should never be allowed. Every man when sure that the part that he worked on is all right should state its degree of "rightness." If clearances in the turbines are O. K., it should be stated just what the clearances are.

It is advisable that a correct copy of the "Maintenance Schedule" should be held at hand at all times, and that managers and superintendents and others in authority should assure themselves frequently that the schedule is being followed.

It may be presumed that most managers of average sized plants make a daily visit to their power stations; but if not, it is strongly recommended that they do so, and that they inform themselves as to the repairs and inspections made, and as to the results obtained. Finally the chief engineer should understand that he is responsible for all that goes on in the station, and that his position depends upon the character of his operation of the plant, and upon the continued increase in the efficiency of the same.

News from the Companies

BOSTON OFFICE.

Mr. Russell Robb will take part in the instruction in industrial organization at the Graduate School of Business Administration, of Harvard University, during the academic year beginning October 1, 1908.

Mr. Charles Hartzell of San Juan, counsel for the Ponce company in Porto Rico, visited these offices on Sept. 15.

Several excursions to nature have enlivened the members of the organization during the last fifteen days. Chief among them is to be mentioned the day of fishing of Mr. Tripp, Mr. Stevens, Mr. George and Mr. Baldwin—a day which served to demonstrate the fact that long contact with public service obliterates all distinction between a haddock and a hake.

Mr. Richardson, of the Houghton County Traction Company, came East in mid-September to buy more cars for the growing traffic of this company.

Mr. Albert R. Chandler, who joined the Statistical Department more than a month ago, has been sent to fill a position with the Houston Electric Company. On his journey thither by water he overtook Mr. J. C. Woodsome at Key West. Mr. Woodsome had started for Dallas a week before on the steamship "Alamo," who broke her propeller blades. Mr. Chandler and his vessel towed Mr. Woodsome and his vessel to Galveston. In all fairness Dallas owes Houston something for salvage.

Mr. D. P. Robinson, president of the Engineering Corporation, is in the West, having left Boston early in September.

An office for handling the Mohawk extension work of the Houghton County Traction Co. has been opened in the Hermann Bldg., Calumet, Mich. Mr. W. L. Locke of the Engineering Corporation is in charge.

Five double truck, semi-convertible cars have been purchased by the Engineering Corporation for the Jacksonville Electric Co. They are being built at the J. G. Brill shops and each will have

four 30 H. P. General Electric motors and air brakes of the same manufacture.

The plan of the Engineering Corporation for making an effective list of active "Executives," of financial, industrial and public service organizations has progressed favorably. It now has the assistance of many members of the staff and its scope is to be increased as soon as practicable.

The papers of Helena, Butte and Anaconda strongly reflect the popular interest of that section in the Missouri River projects of the Engineering Corporation. Very few details of the progress at Hauser Lake escape notice.

CANTON, MASS.

The Blue Hill Street Railway Company has installed aluminum cell type lightning arresters in its power station.

N. H. Daniels, Jr., of the statistical department, called on us during the month.

August 30th was the banner day for this company. We took more money by eight dollars, while our passengers carried were some 2894 fewer. This is due to the one cent increase in fare.

Superintendent Buchanan and Despatcher Spaulding had a narrow escape in an auto upset September 5th. The steering gear broke and the machine turned turtle.

LOWELL, MASS.

A contract has been entered into with the Stone & Webster Engineering Corporation for installing stokers, new boiler feed pump and turbine ventilating system at our station. The Taylor gravity underfeed stokers will be installed.

A most successful automobile race was held here on Labor Day, September 7th. There were several foreign cars and a good number of American cars in the contest. It was estimated that nearly 150,000 people witnessed the race. It was agreed by the experts that the Merrimack Valley course over which this race was held is the best in the country. We believe that the intention is to hold an annual race, and great effort is being made to arrange to have the Vanderbilt cup race held on this course.

COLUMBUS, GA.

On August 13th, Mr. J. P. Ingle, assistant superintendent of the gas light company, left Columbus for Baton Rouge to fill

the position of superintendent of gas department of the Baton Rouge Electric & Gas Company. Mr. Ingle took his wife with him and expects to keep house in Baton Rouge.

Mr. F. J. Neagle has returned from a ten days vacation trip to Boston.

Mr. H. M. Corse has returned from a vacation very pleasantly spent in Florida.

Mr. George Priest of the Engineering Corporation, who has charge of the reconstruction of the gas plant at Baton Rouge, recently spent a week in Columbus in connection with the present and future improvements to the gas works.

Mr. Karl Andren and Mr. Ziskind visited the city during the month for the purpose of buying secondhand apparatus and scrap metal from the company.

Mr. Lowd, manager of the southwestern district of the Stone & Webster Engineering Corporation, visited us during August and carefully examined our track conditions, which will be the subject of a report from him which is awaited with very great interest.

The new greenhouse and improvements to old greenhouses which were completed during the summer are now in active operation at Wildwood Park under Florist Keheley's management. The greenhouses have been stocked with a large supply of field grown carnations and other flowers. An increase in the amount of business is expected, and the improvements to buildings and fixtures are a great convenience in the proper and economical operation of the flower department.

Columbus is being very well advertised in a pictorial and news way at the present time. A very beautiful little pamphlet called the "Home Book," filled with pictures and appropriate sayings, has been issued by the Jordan Company and widely distributed; and an illustrated article in regard to Columbus and its possibilities as a manufacturing center will appear in the October number of Taylor-Trotwood Magazine.

Considerable building has been going on in Columbus this summer, and much improvement is noted on Broad Street, particularly those buildings owned by Mr. A. Illges. Many residences are also going up, and real estate agents report prospects of very few vacant houses during the coming season. All of the new houses and many of the old residences are being wired for electric service.

The recent flood at Augusta, Ga., aroused much sympathy

among the people of Columbus and large subscriptions and car-loads of supplies have been sent there.

The policemen and firemen of Columbus and other cities of Georgia were greatly disappointed that the bill providing free transportation for them, which passed both the House and Senate in Atlanta before the adjournment of the Legislature, was disapproved by Governor Smith on the ground that cities should not be under obligation to street car companies and that any free transportation privileges should be a matter of contract or agreement.

Great enthusiasm has been aroused by the fact that Columbus has been admitted to the South Atlantic League and much interest is being shown in what name to apply to the ball team, the names "The Electrics," "The Live Wires," "The Water Power Wonders," etc., having been suggested as suitable. Much enthusiasm is expected to be shown in base ball, and already \$5000 or more has been subscribed to support the team.

JACKSONVILLE, FLORIDA.

In no way is the rapid growth of the city of Jacksonville more forcibly indicated than by the increase of \$2,093,000 in tax valuation for the present year. The total valuation for taxing purposes, according to the assessment roll for 1908, is \$24,295,000.

Just what the floods in Georgia meant to the people of the cities and towns that suffered from the heavy rains was brought home to Jacksonville very forcibly during the early part of September, when the precipitation in one day reached five and one-half inches. On the ninth of the month rain poured down continuously for fifteen hours, and on the following day there was but little interruption. As a result, a large portion of the city was flooded and in some sections men and women were marooned for many hours, taking refuge chiefly in the stores on the main street. The water in the new Myrtle avenue subway that has been constructed beneath the tracks of the steam railroad showed a depth of 12 feet, and the surface of the water came within about two feet of the tracks above. The railroad yards were flooded and the water stood three and one-half feet above the floor of a bridge across one of the creeks of the city. Many stores and dwellings were flooded and several of the streets became swirling rivers as the water rushed towards the business section of the city. In front of the Union Depot the street was almost impassable, and at

one of the busiest corners in the city the water stood several feet deep. In some parts of the city it became necessary for the merchants to construct dams across the doorways of their establishments to hold the water in check. Out in Springfield, a suburb of the city, the grading and paving of streets formed a basin for the floods, and as a consequence a territory of about seven blocks long and four blocks wide greatly suffered and the streets were rendered impassable. In about one hundred homes the inmates were isolated, and hardship would have followed were it not for the proximity of neighbors and the fact that the telephone service held out against the elements. Even on the morning of September 11th water was rushing from the railroad station to the river, out through the viaduct, the great concrete structure which spans the railroad tracks. With all the inconvenience to which the people of the city were put on account of the flood, it is gratifying to say that no death or serious injuries are known to have resulted from it. The street car service was interrupted for a sort time in the flooded sections of the city.

On August 22nd Jacksonville completed the series of base ball games which was begun on April 16th, and carried off the fifth annual championship of the South Atlantic Baseball League by a goodly margin. This is the first time this city has had such an agreeable experience, and it comes as a fitting climax to the high enthusiasm which has existed throughout the entire season. The race was close and exciting until mid-season, when Jacksonville drew ahead and soon made the gap so wide that a month before the finish all hope of winning the pennant had to be abandoned by the other contestants. Savannah was the only team that had given Jacksonville a real fight, and this nine also outclassed the others so much that it had almost a "walk-over" for second place.

Dr. P. C. Perry, chief surgeon for the Jacksonville Electric Company, is enjoying a vacation in Canada, where he has gone for rest and to recuperate from the effects of an operation for appendicitis. The operation was performed the latter part of August and was thoroughly successful. Only a few days prior to the operation, Dr. Perry had performed a similar operation on one of the company's motormen, C. T. Purvis. The latter has been released from the hospital and is reported to be on the rapid road to recovery.

Col. W. E. Kay, senior member of the firm of Kay, Doggett, & Smith, our attorneys, has returned from an extended trip through Europe.

Mr. E. M. Carney, who has been conducting the publicity campaign which is being carried on by the Jacksonville Electric Company through the daily papers, left here on August 31st to return to the Boston office and his home at Lawrence, Mass.

Mr. G. M. Robbins, one of the former attaches of this office, but now with the Savannah Electric Company, in the auditing department, spent his vacation of two weeks in Jacksonville.

KEY WEST, FLA.

An account of Mr. Henry M. Flagler's great feat in constructing a railroad over the Florida keys to Key West was given in the March number of the Journal. Mr. Flagler's aim is to shorten the distance between New York and Havana by twenty-four hours. At that time it was stated that the line was completed to within forty-seven miles of Key West, and that on the remaining stretch eighty per cent. of the construction work had been done. As a more recent development, it may now be stated that one of the barges loaded with cement for the Key West terminal dock of the Flagler railroad arrived here a few days ago. Tools and other equipment are also on the ground and the work on the terminal will be soon under way again. The engineer in charge is wanting laborers at \$1.25 per day, but is meeting with no response, and the help for the terminal work may have to be brought from the North, or from the other keys on which work is now in progress.

Mr. W. E. Terry is now in the assistant treasurer's department.

Mr. and Mrs. C. A. Woodsome, while on their way to Dallas, Texas, via Mallory S. S. "Alamo," spent a week in this city. Before their departure, a dance was given in honor of the "Alamo" family at La Brisa.

The Ladies of St. Paul's Church have formed a "Circle of Charity" for aiding the poor and sick. To raise funds for this purpose a series of entertainments, including a "Charity Ball" at La Brisa, The Key West Electric Company's resort, is in preparation.

To eradicate old wiring, defective in the light of the new Code, we have started to give publicity to the Underwriter's rules through the medium of our daily and weekly papers, and we have already found that our efforts in that direction are not wasted, as evidenced by the inquiries of persons who had their places wired less than two years ago according to National Code, and who wish to keep up with its changes.

With the steamer that is expected to leave New York on Wednesday, Sept. 30th, 1908, the Mallory Steamship Company will inaugurate a new schedule for its Key West business. The New York-Galveston steamers will, after the above date, touch here only as specials, when needed in either direction; and in their place we are to have the company's New York-Mobile steamers touch here on their South bound trips on Mondays and their North bound trips on Wednesdays. These steamers will also touch at Tampa on Tuesdays and Mondays.

HOUGHTON COUNTY, MICH.

The Stone & Webster Engineering Corporation assumed charge of the work on the Mohawk Extension on August 19th. Mr. W. L. Locke is the superintendent of construction, having with him Mr. D. L. Roberts as accountant. Mr. F. H. Abbott of the Houghton Companies is acting in the field as assistant engineer. Seventy-five per cent. of the grading was completed and all ties, rails, track fittings, copper wire and overhead fixtures were on the ground by the middle of September. The material for an overhead crossing at Centennial is being manufactured by the Wisconsin Bridge & Iron Company, the contract calling for the erection of the same by September 25th. Track laying began on September 14th. The culverts are all completed. At present about one hundred and ninety-five men and twenty-five teams are being employed. All grading and laying of track was sublet by contract to Byers & Company, of Houghton, Mich. The rail bonding and overhead is to be done by the corporation. The overhead construction has been simplified, however, as the feeder, arms and brackets are to be attached to the lighting company pole line, approximately one-third of which line is now completed.

A new town site called Copper City is being built by Calumet interests in close proximity to the Ahmeek Mine. This town is admirably located on the Keweenaw Central railroad, and is the natural outlet for the adjacent districts. The land is high and well drained; also, an abundant supply of good water is available. In order to supply the city with electricity, the lighting company has made an extension of approximately one-half mile. It is estimated that before snow flies twenty buildings will be erected, including the railway station, coal and lumber yard, etc. Two arc lamps have already been placed on street intersections, and indications are good for considerable business in this district. The

parties interested are confident that within the year one hundred buildings will be completed.

The Houghton County Street Railway Company was purchased the first of September by the Houghton County Traction Company. It is the intention of the Traction Company to operate the street railway as usual, and also to build the extension to Mohawk.

Electric Park has this year been more popular than ever. Up to September 1st the attendance was 48,700. So far this year no accidents or mishaps of any kind have occurred.

Many parts of the Copper Country have been threatened by forest fires during the last month. So far neither the lighting nor the railway company has lost any property, although at two or three points the lines of both were threatened. At many of the mine locations the constant work of the fire departments has been the only thing that prevented serious damage. The woods and material in the whole district are so dry that it has been practically impossible in many cases to hold the fire in check. So far none of the larger towns in the district have been threatened.

During the past month two contracts have been closed by the lighting company for power, one with the Wolverine mine to furnish all light and power for a period of five years. It is the intention of the mining company to install five triplex electric pumps. These pumps will work against a head of from 250 to 650 feet. The other contract, for approximately 165 H P, is with one of the large coal companies. These motors will handle coal from the vessel to the dock and to the cars. It is expected that from 50,000 to 100,000 tons of coal will pass through this dock yearly.

Mr. Herbert Nash, Jr., of Boston, arrived in Houghton on September 1st to assume his duties as assistant superintendent of the lighting company at Calumet. He succeeds Mr. R. P. Gifford, who becomes superintendent.

Two municipal contracts for our series arc lighting were closed during the previous month for a period of five years, one of these being with the Franklin Township and the other with Houghton County.

The car barn at Hancock is being overhauled to accommodate the increase of equipment due to the Mohawk Extension. New tracks are being laid under the barn for car storage.

EL PASO, TEX.

During the month of August two trolley rides for our train-

men took place, one for the day men, and another for the night men. The combined purpose was to foster friendly relations between the trainmen and the officers of the company, and also to furnish opportunity to talk to the men about the prevention of accidents. Both occasions were very pleasant and successful; they have resulted in a decrease in the number of accidents.

During the month of August and the early part of the month of September, arrangements were perfected for burning oil at our plant instead of slack coal. Mr. Usener, chief engineer of the Houston Electric Company, spent ten days in El Paso assisting our operating force in the burning of oil, and was accompanied on his trip to El Paso by Mr. Van, claim agent of the Houston Electric Company.

The El Paso Electric Railway Company has recently received a new sprinkler car of 4,000 gallons capacity, manufactured by the J. G. Brill Company, of Philadelphia. The car is equipped with double trucks of the Brill 27-G type and four G. E. 81 motors. This car was purchased jointly by the City of El Paso and the El Paso Electric Railway Company, and for its operation the city furnishes the water and the company the labor and power to operate the car. This is the first car of the kind that has ever come to El Paso and has excited much interest.

(C. W. Kellogg, Jr.)

TAMPA ELECTRIC, FLA.

Tampa is about to start an active campaign to advertise the resources of the city. The Tampa Publicity Club has been organized with a large charter membership, and the work of securing new members and raising funds for the work is being pushed energetically. This club is independent of both the Board of Trade and Chamber of Commerce, and intends to do nothing but advertise the city and surrounding country.

Up to August 31st, the deficiency in rainfall for the year had reached 14 inches at the local weather bureau, but the first of September ushered in heavy daily showers, which have raised the water in the river several feet. The hottest day in nineteen years at Tampa, or since the weather bureau was first established here, occurred on August 2nd, the thermometer reaching 96.4 degrees. Previous to this our hottest day was in July, 1902, the mercury reaching 96 degrees.

A co-operative grocery is being started in Tampa. This is owned by two hundred Cuban cigarmakers, and they are very enthusiastic about the scheme. Provisions will be sold to stockhold-

ers at cost, but at regular prices to other purchasers patronizing the store, the profit from these sales to go to the stockholders.

The big Stachelberg factory, the second largest independent factory in the world, was completed the first part of September, and is now occupied. This is a model factory in every respect, and replaces the much smaller building owned by this firm which was destroyed in the fire of March 1st, although the new building is located in a different section of Ybor City where more room could be secured than at the old site.

Mr. E. B. Powell of the Engineering Corporation, who has been in Tampa for several months studying power house conditions, left for Savannah, September 6th.

Miss E. S. Wilson, of the local office, spent her vacation with relatives on the picturesque Manatee River, where some of the finest orange groves in the state are located.

Mr. B. M. Harrison, our claim agent, went out on a farm in South Carolina for his annual rest, in the neighborhood of which there are fine fishing grounds.

Mr. R. E. Faulkner, chief clerk, left for Brockton, September 3rd, to spend the remainder of the month with relatives and friends. This is Mr. Faulkner's first trip home since coming to Tampa three years ago.

MINNEAPOLIS, MINN.

A factor typical of this section of the country is the huge proportions a business proposition assumes, once its feasibility is assured. In considering the electrical power business this is an item worthy of careful consideration. Wholesale manufacturing concerns when creating a new enterprise build to such immense proportions, that nowhere in the country is there to be seen a like warehouse or factory. Instead of a power installation of a few hundred horsepower, an aggregate of a thousand is not uncommon. So it is in the lighting of retail stores, in sign and window decorating; and recently the new ornamental street lighting proposition has been received in the same openness of manner. One long stretch of very artistic and effective lighting so very emphatically fixed in the minds of the people the advisability of prolonged daylight hours, of illumination of the business streets by night, of light as a medium to increased trade and effect greater publicity, that already merchants of the competing portions of the city have awakened to this form of advertising, with the result that four times the initial installation of posts installed but two months ago

have been connected up to our Edison D. C. underground system, or have been contracted for. Then, too, hotels and private houses, appreciating this form of lighting, have installed it on their premises, making a very attractive approach. The very near future will find Minneapolis a city profusely lighted in this unique style.

On the last of August, Mr. A. W. Hunking spent a few days in Minneapolis while en route to Helena, Montana.

Two small items that may prove of interest to the members of other contract departments have recently been called to the attention of this office. Many photographers have experienced the difficulty of printing pictures at all hours of the day or night. An ingenious device has been devised by a local photographer by means of which a dozen 16 c. p. lamps are placed in an asbestos lined box large enough at the top to hold the largest standard size plate or film. Over the top of this box a hinged lid drops over the plate, and at the side a switch is thrown on, and in this manner the timing of the print can be more accurately determined.

In mounting photographs this same photographer uses an adhesive paper, and with the aid of heat furnished by an electric flat iron makes a much smoother finish than is possible by any other method.

Minneapolis is the second largest Tungsten lamp market in the country. Realizing this fact, the Tungsten Company of New York, manufacturers of Tungsten lamp fixtures, have established a branch office in this city, and to aid in the display of this material a portion of our display room is to be used to demonstrate its values.

Mr. Sharkey of the Platt Iron Works has spent several days in an examination of the St. Croix water turbines.

Mr. Judson Stone, chief operator at the Main St. generating station, has been in charge of the St. Croix plant for the past month. Through Mr. Stone's assistance, Mr. Jeff. Alexander has been familiarizing himself with the operation of this plant.

Mr. Marcy L. Sperry, former superintendent of this company and present manager of the Savannah Electric Company, recently spent two weeks' vacation in this city.

The state of Minnesota is essentially a productive state—its natural resources make it what it is today. Iron mining in its northern parts give employment to large bodies of men. Its larger cities—Duluth, St. Paul and Minneapolis—are all great manufacturing and distributing centers. But this is not truly typical of

the whole state: Minnesota is an agricultural community, and as such is surpassed by no state in the Union. Wheat is the chief item of product, yet grains of all sort flourish well. Minnesota farmers are unusually successful and of the higher class. Minnesota soil is easily tilled, being remarkably free from rocks and of a sandy nature. It is not uncommon to note for miles these undulating prairie fields and yet not see a single boulder. The farmer of Minnesota is undeniably Scandinavian, and a more earnest and industrious class could not be found. The rural districts are the basis of the buying power of the country. Probably 90 per cent. of the people of Minnesota are devoted to rural affairs, either directly or indirectly. When a rural population becomes highly successful, it often follows that country fairs abound to display live stock, etc., to exchange ideas and generally to benefit the community. So it is in Minnesota; only, as usual, in Minnesota this affair attains huge proportions.

An annual convention is held in a large area lying between St. Paul and Minneapolis, and gathered here three hundred and fifty thousand people reap the benefit of the great "Minnesota State Fair"—the largest fair of its kind in the country. Here, annually, the Twin Cities, representing the northwest in harvesting machinery, do the bulk of the business for the ensuing year: and to these cities, it is estimated, an average of two hundred dollars per person is brought and spent by the rural population for supplies of various natures. This is the height of the great commerce interchange of the middle Northwest yearly, and undoubtedly is a great uplift to the community. But from a central station standpoint, a more technical aspect presents itself.

Within this area, covering many square miles of ground, are beautifully ornamented buildings by day, and at night one cannot but notice the artistic festooning of lights and outlining of buildings. The beautiful domes are all well lighted, and even in the stables, where hundreds of horses, the best of the Minnesota prairies, are kept, electric bulbs are found by thousands. The power in the buildings and in the great machinery on the outside is mostly electrical. This power and these lighting arrangements were all designed for their specific purposes by The Minneapolis General Electric Co.; by this company the current is furnished for ten thousand incandescent bulbs, and in all to an aggregate of eleven hundred horsepower. Directly after leaving sub station "A," where the three-phase current from the St. Croix River is

stepped down to 13,800 volts, a specially constructed line, protected throughout from lightning by overhead grounded wire, is tapped to the main tie line, and through the woods makes its way to the State Fair Grounds several miles distant. Here, at a rotary sub station recently constructed, the current is again stepped down to 220 volts. When one considers that this power is taken direct from the high tension lines from St. Croix River, where the water wheels generate the energy, one realizes the value of attaining such a class of business at a season of the year when the plant is by no means heavily taxed. Each year greater numbers attend this fair, and each year its success becomes more firmly established. With the greater success, the natural tendency is toward yet greater illumination, and greater illumination means to this company an increased revenue.

(R. H. McGrath.)

BELLINGHAM, WASH.

Early last autumn the erection of a large flouring mill was commenced in that part of this city known as the "South Side." Two 2200 volt three phase motors, one of 50, the other of 85 H. P., were to be installed, and this company contracted to furnish power for them.

At that time there was no three phase power circuit to the south side, the motors in the canneries and shops being fed from the 500 volt D. C. railway service. Owing to the variable speed and the risk of fire around lacquering machines in the canneries, it was thought best to eliminate the D. C. motors as quickly as conditions would permit.

The lighting conditions in that part of the town were even worse than the power. A pair of No. 1 wires three and one-half miles long, running from York Street substation, supplied the total south side lighting load, incandescents and city arcs. During the peak load the voltage at York Street had to be boosted from 2300 to 2500 to maintain the voltage at the extreme end of the line. Consequently people nearer the source had excessive voltage and poor regulation.

A careful estimate showed that the cost of a 22,000 volt transmission line, 11,000 feet long, joining the Nooksack line outside the York Street substation with a new brick substation to be built on the company's property at the Gas Works, the substation equipment, and the 2300 volt lines leading from the station, would amount to only a very small increase over the cost of a 2300 three phase power line from York Street to the flour mill and canneries.

Moreover the 2300 volt line would have allowed of no increase in load and would not furnish lighting current. The 22,000 volt line and substation, however, would furnish light and three phase power in abundance and leave a reserve for a number of years to come.

It is rather unusual to build a high tension transmission line and substation for such a short distance and, if it had not been for the peculiar geographical arrangement of the city, it probably would not have been warranted.

During the last few months a couple of interesting problems concerning our 3300 H. P. Victor Turbine at Nooksack Falls have presented themselves, and have been met and solved by Mr. Shuffleton, of the Engineering Corporation.

The first one really dates back to the time of the installation of the plant, when the makers of both turbine and governor were "up against it" for speed regulation. The two penstocks, 44 and 48 inches in diameter, lead down a distance of about 700 feet from the forebay with a fall of about 175 feet. The inertia of this great body of water is terrific, and with the most sensitive governor imaginable, acting on the gates alone, it would not be possible to keep the speed of the wheel within reasonable limits of constancy under the violent fluctuations of the railway load. When the plant was first started the voltage variation was so bad as to jam the Tirrill regulators in both directions, causing much trouble and poor service. The governor people attempted to remedy this trouble by means of a couple of spring relief valves, connected to the penstock just ahead of the wheel. The function of these valves was to allow a certain portion of water to flow at all times. If the load fell off and the wheel started to speed up, the valves were supposed to open and allow part of the water through without touching the wheel. As a matter of fact, when the load fell off the governor would close the gates, the relief valves would not open quickly enough, the pressure would run way up and undo the effect of the governor. By this time the load would suddenly come on just in time to meet the valves wide open. The pressure would drop way down when most needed and the wheel would go to the other limit of speed. And so it went on like a game of blind man's buff, the governor, the water wheel, the water and the relief valves all trying to find one another but never succeeding.

The theory was correct, however, and Mr. Shuffleton availed himself of this in the design of a number of special balanced relief valves. These valves consist of a cylinder in which is a revolver

whose top view resembles that of a longitudinal section of a dumb-bell. Water comes in at the bottom and leaves through two pipes at opposite sides of the cylinder. The revolver is turned by a lever, which in turn is controlled by a counterweighted cable wound around a wheel on the governor shaft. This arrangement makes the relief valves open or close just in proportion to the turning of the governor shaft, opening when the gates close and vice versa. These were found to give very good satisfaction and the speed regulation was much improved.

The installation of two induction motors in a flour mill last April made much better speed regulation necessary and this was obtained in the same manner. Two new large relief valves were installed, all of them allowing nearly 1200 Kw. of water to flow down the penstocks at all times. The function of the governor then becomes that of a director, sending the water either through the wheel or the relief valves but maintaining at all times a practically constant speed of water in the penstocks, thereby eliminating the inertia effects.

The question of speed regulation was no sooner settled than a new one presented itself. Owing to the fact that the wheel is of a lateral as well as an inward flow type, there is an end thrust of approximately five tons on the shaft. The turbine manufacturers took up this thrust by means of a combination mechanical and high pressure thrust bearing. The mechanical part consists of a number of rings fastened to the shaft interlocking with corresponding rings on a jacket fastened to the bearing, the whole running in oil. The high pressure thrust is on the shaft next to the mechanical thrust under the same jacket. It consists of a ring of 155 sq. in. area fastened to the shaft, running free in a cylinder made water tight by means of a stuffing box around the shaft. Water at a pressure of 70 lb. turned into the cylinder would press the ring and shaft back against the thrust and the whole rotating system would "float" to a nicety. Sand and grit of one kind and another have so worn these bearings as to make them practically useless.

Instead of attempting to fix this bearing, which would have been a long, expensive job with no certainty as to results, Mr. Shuffleton let it go entirely and put a new thrust on the generator end of the shaft. It consists of a shaft, one end of which is fastened to the generator shaft by a cap and machined bolts, the other end resembling an ordinary piston head, 14 in. in diameter.

This head revolves in a cylinder which is bolted to the pedestal of the generator bearing. Water at 70 lb. pressure in the cylinder brings a thrust of about five tons on the piston head, which in turn is transmitted to the generator shaft. The scheme has been very successful, the moving system floating as well with the new thrust as with the old. It was completely installed for an amount less than the cost required to take the old bearing apart.

That business confidence has returned again is well shown by the renewed business activities that are taking place in this city. Foremost among these is a proposed cement plant to be built near here by the Balfour-Guthrie Company. It is to have an initial capacity of 3000 barrels per day, with an ultimate capacity of 10,000 barrels. This company is now negotiating to supply them with power from Nooksack Falls. In order to do so it will be necessary to enlarge the capacity of Nooksack to 4000 H. P., or about double its present electrical capacity. The voltage on the transmission line would probably be raised to 60,000 and a sub-station erected at the cement plant. Such a plant would be of great commercial benefit to this city, in that it would form the nucleus of a great cement export center. Experts have said that the raw materials for the manufacture of cement exist in unlimited quantities in this county and of as fine a quality as any in the world.

(L. R. Coffin.)

EVERETT, WASH.

The County Fair, Sept. 1st to 5th inclusive, was perhaps the most successful, both as to exhibits and attendance, ever held in the city. Although the grounds are centrally located, the event contributed noticeably to the earnings of the railway department.

It is the present purpose of the Fair Association to secure other and more spacious grounds on the outskirts of the city, which will make the annual fair and other events held thereon valuable assets to the earning capacity of our railway system.

Foundation work on the new Great Northern railway depot was begun a few days ago. This will be a handsome structure of brick and stone, 255 x 50 ft. The contract price is \$81,000. Everett, by the way, is the only city on the line of the Great Northern railway to secure a depot this year.

An appropriation of \$200,000 for a Federal building in this city will soon be available, and an agent of the government is now here looking over the several locations offered as building sites.

The indications now are that the big smelting works in this

city, which have been practically idle during the past year, will resume activity at an early date. This plant is owned by the American Smelting & Refining Co. and ore is now being received from Japan and elsewhere. It is thought the principal reason for the reopening of this industry is that the company's big plant at Selby, Cal., has been closed by the fruit ranchers, who complained that the arsenical and sulphur fumes killed their trees. Owing to the fact that the Selby plant is closed and may remain idle indefinitely, there is a belief that the Everett branch may again be made one of the important plants of the company on the Pacific coast. The resumption of the smelter would mean an addition to our central station load of about 300 H. P.

The management has instituted a sort of "get-together" meeting at frequent intervals for the several department heads. Matters bearing on the business end as it relates to the public, as well as to the operating department, come up in the natural way for discussion and recommendation. These gatherings are receiving generous support from all of us, and the meetings already held demonstrate that they can be made not only instructive and helpful to all concerned but enjoyable as well.

Financial conditions continue to improve. Better prices for lumber and shingles keep all of the local wood working industries busy full time.

(Louis Lesh.)

SYDNEY, CAPE BRETON.

Business still remains quiet in this locality. Coal shipments to St. Lawrence ports are being curtailed, due to decreased demand of the manufacturers.

The Dominion Iron and Steel Company are operating their works with full shifts, the business depression having affected them very little. We understand that this company is about the only steel company in America that has not had to curtail its production during the past six or eight months, and we are also advised that they have contracts booked sufficient to keep the plant going for the next six months or more.

We have received our new Terrill regulator from the Canadian General Electric Company, and expect to have it in operation within a few days. This will give us a much needed improvement in our regulation.

Although we have had an exceptionally fine and warm summer, the tourist trade has been very light throughout this section. This has been due, no doubt, to the business depression prevailing

in the States, and also to the tercentenary at Quebec, which drew large crowds.

Mr. Walter G. Ross, superintendent of lighting, is at his home at Port Perry, Ontario, for his holidays. He expects to visit the Boston office before he returns to Sydney.

Mr. Wilfred P. Drake, collector, is also away on his vacation.

Mr. G. G. Spencer, assistant treasurer, leaves next week for his home in Nova Scotia, where he intends spending his vacation.

(A. F. Townsend.)

PONCE, PORTO RICO.

Ponce affairs have been moving very quietly the past month and with but little change in business conditions. There is perhaps a slight improvement over earlier months, but we do not expect anything marked until the beginning of the cane crop, at which time business in general should improve considerably. We are having a moderate amount of rain, but not as much as some of the sugar plantations need. The coffee crop is variously estimated from fair to excellent, according to the locality in which one makes inquiries. It is probable that for the island as a whole it will equal that of last year.

Governor Post has called an extra session of the House of Delegates in order to appropriate the necessary funds and enact the necessary legislation for the carrying out of the irrigation scheme on the south side of the island, a description of which appeared in the Journal of June, 1908. It is to be hoped that the matter will be settled favorably, as the completion of this work means more prosperous times on the south shore, and as it cannot but favorably affect our business.

Work has been commenced this week on the sea wall for the wharf which we are to build on Penoncillo Point. Stone is being delivered to our cars on Leon street in this city and hauled by us to the Playa, where, by means of our coal handling derrick, it is placed on lighters. These lighters in turn carry it to the coral reef and deposit it in the proper location.

Last week we had a slight accident to the Ball & Wood engine, due to the breaking of a valve bell crank. This permitted the rod to drop and jam, thus breaking the governor pendulum from the fly wheel. The engine was shut down by means of the monarch engine stop before any further accidents could happen. Repairs were made by our own force and the local shop, and the engine is again running as usual.

QUOTATIONS

ON

SECURITIES OF PUBLIC SERVICE CORPORATIONS

UNDER THE MANAGEMENT OF

OUR ORGANIZATION

SEPTEMBER 20, 1908

NOTE:—Quotations are approximate. Unless indicated to the contrary Bonds and Notes are 5 per cent and preferred stocks 6 per cent non-cumulative. Accrued interest should be added to quotations on Bonds and Notes.

COMPANY	BONDS	PREF.	COM.
Blue Hill Street Railway Co., The	95	No pref.	....
Brockton & Plymouth St. Ry. Co.	93 ¹¹	No pref.	....
Cape Breton Electric Co., Ltd.	92½	75	15
Columbus Electric Co.	90	....	....
Columbus Power Co., The	93 Notes 95	....	....
Dallas Electric Corporation ^{7, 8}	85	50 ³	15
Edison Elec. Ill. Co. of Brockton ^{Notes}	105½ 100	No pref.	165
Electric Light and Power Co. of Abington and Rockland	100	No pref.	160
El Paso Electric Co. ⁸ Notes	92½ 96 ⁴	85	41
Fall River Gas Works Co.	No bonds	No pref.	245
Galveston Electric Co.	92½	....	....
Galveston-Houston Elec. Co.	....	85 ¹	30
Houghton County Elec. Lt. Co.	97	22½ ⁶	13 ⁸
Houghton County St. Ry. Co., The	93	No pref.	No Com.
Houghton Co. Traction Co.	92	95	20
Houston Electric Co. ^{6, 7}	98	....	....
Jacksonville Electric Co.	95	95	80

COMPANY	BONDS	PREF.	DOM.
Key West Electric Co., The	....	....	....
Lowell Elec. Lt. Corporation, The	100	No pref.	190
Minneapolis General Elec. Co., The	98 Notes 100 ⁴	100 ^{1, 6}	85 ⁶
Northern Texas Electric Co.	96 ² Notes 97 ³ / ₄	88 ⁷	85 ⁷
Pacific Coast Power Co.			65 ⁶
Paducah Traction & Lt. Co. ⁷	80	50 ^{1, 3}	15
Pensacola Electric Co.	95	75 ¹	20
Ponce Electric Co.	100 ⁴	No pref.	....
Puget Sound Electric Railway	97 ⁶ Notes, 1911 96 Notes, 1912 95	87	41
Puget Sound Power Co.	97 ¹ / ₂	No pref.	.... ⁹
Savannah Electric Co. ^{6, 7}	80	50	12 ¹ / ₂
Seattle Electric Co., The ^{1st m'tge}	105 ^{6, 7, 8}	95 ^{6, 7, 8}	82 ^{6, 7, 8}
Consol. and Refund m'tge convertible	100		
" " " " non-con.	97		
Notes	96 ³ / ₄		
Tacoma Railway & Power Co.	95	No pref.	.... ¹⁰
Tampa Electric Co.	95	No pref.	107 ¹ / ₂
Whatcom County Ry. & Lt. Co.	92 ¹ / ₂	87 ¹ / ₂ ¹	88

1.—Cumulative. 2.—Bonds of Northern Texas Traction Co. 3.—5 per cent.
4.—6 per cent. 5.—Par \$25. 6.—Listed Boston. 7.—Listed Louisville. 8.—Listed
Columbus, Ohio. 9.—Held by The Seattle Electric Co. 10.—Held by Puget Sound
Elec. Ry. 11.—4 ¹/₂ per cent.

STONE & WEBSTER

Boston - - - 147 Milk Street
Chicago, 604 First National Bank Bldg.

NOTE.—The Securities Department handles securities for those wishing to purchase or sell. Requests for information in regard to any of the above companies will be promptly answered at any time by this Department.

COUPONS AND DIVIDENDS DUE

	Per Cent
Oct. 1st. Blue Hill Street Railway Company, The, First Mortgage 5's, 1923.....	2½
Oct. 1st. Columbus Electric Company, First Mortgage Collateral Trust 5's, 1933.....	2½
Oct. 1st. Columbus Power Company, The, First Mortgage 5's, 1936.....	2½
Oct. 1st. Columbus Power Company, The, coupon notes, 5 per cent, 1911.....	2½
Oct. 1st. Columbus Railroad Company, First Mortgage 5's, 1937	2½
Oct. 1st. Dallas Electric Corporation, First Mortgage Collateral Trust 5's, 1922.....	2½
Oct. 1st. Electric Light & Power Co. of Abington & Rockland, The, First Mortgage 5's, 1919.....	2½
Oct. 1st. Everett Railway & Electric Company, First Mortgage 5's, 1921.....	2½
Oct. 1st. Everett Railway, Light & Water Company, Consolidated Mortgage 5's, 1925.....	2½
Oct. 1st. Tacoma Railway & Power Company, First Mortgage 5's, 1929.....	2½
Oct. 1st. Houghton County Street Railway Co., The, preferred stock, 6 per cent.....	3
Oct. 1st. Seattle Electric Company, The, preferred stock, 6 per cent.....	3
Nov. 1st. Galveston Electric Company, First Mortgage 5's, 1940	2½
Nov. 1st. Jacksonville Electric Company First Mortgage 5's, 1927.....	2½
Nov. 1st. Paducah Traction & Light Company, Collateral Trust 5's, 1935.....	2½

Nov. 1st.	Ponce Electric Company, First Mortgage 6's, 1927	3
Nov. 1st.	Seattle Railway Company, The, First Mortgage 5's, 1921.....	2½
Nov. 1st.	Terre Haute Traction & Light Co., Consolidated Mortgage 5's, 1944.....	2½
Nov. 1st.	Whatecom County Railway & Light Company, First Mortgage 5's, 1935.....	2½
Nov. 1st.	Cape Breton Electric Company, Ltd., preferred stock, 6 per cent.....	3
Nov. 2nd.	Edison Electric Illuminating Company of Brock- ton, capital stock.....	3½
Nov. 2nd.	Houghton County Electric Light Company, pre- ferred stock, 6 per cent.....	3
Nov. 2nd.	Houghton County Electric Light Company, com- mon stock, 5 per cent.....	2½
Nov. 2nd.	Lowell Electric Light Corporation, The, capital stock*	2
Nov. 16th.	Tampa Electric Company, capital stock.....	3½

*Quarterly.

LIBRARY NOTES

The Library can generally obtain reduced subscription and renewal rates on periodicals. Members of the Stone & Webster organization who may care to avail themselves of this opportunity for 1909 should send their requests to the library before the end of October.

"Moody's Manual of Railroad and Corporation Securities" for 1908 contains several new features. Among these are the tabulated earnings of steam railroads for the year ended June 30, 1908. On the other hand, the statements of banks and trust companies which have previously appeared in this publication have been omitted.

The Commercial National Bank of Chicago has issued its tenth annual report on "Crop Reports and General Business Conditions." This interesting publication contains a "review of conditions as they exist today as seen by some four thousand bankers and business men." It is amply supplied with statistical maps, charts and tables.

A great amount of useful matter with reference to the physical and financial sides of street and elevated railways in the United States is contained in the annual supplementary sheet of the Electric Railway Journal, which appeared with the issue of August 29, 1908.

"Relative Hygienic Values of Gas and Electric Lighting," by Samuel Rideal, D. Sc., of London, is a report of scientific investigation and has many interesting tables and diagrams. "The medical conclusions are in accord with those arrived at from chemical and physical data, and demonstrate that the choice between the two systems of lighting does not depend upon hygienic conditions."

Recently published by the Massachusetts Bureau of Statistics of Labor is "The Cost of Municipal Government in Massachusetts." It is the first annual report on the comparative financial statistics of cities and towns, by Charles F. Gettemy. The bulk of the work consists of tabular statistics, which are preceded by some 60 suggestive pages of introduction, explanation and analysis.

LIBRARY OF STONE & WEBSTER

Current Literature

Selections from Recent Magazines and Book Accessions.

Ed, *, and + are used in cases of magazines to indicate editorial, illustration, and map or diagram respectively. But these symbols do not have the same significance in the case of book numbers, all of which are preceded by an asterisk.

Concrete and Construction. (See also 14, 15)

- 1 Building Codes, Germany. New regulations of Prussian gov't for reinforced concrete bldgs: rules for statical computations; formula for computation of stresses. T 191. 7|08. 69-7.5p+

Lighting. (See also 16, 17)

- 2 Present statis of flaming arc lamp: principles of the lp; flaming carbons; mechanical features; illuminating features; economy. AA Wohlauer. El'l World 9|5|08-497-3.5p+

Motors, Generators, & Stations.

- 3 Pacific Light & Power Co. Modern stm pr central station at Redondo, Cal.; plt of Pacific Lt & Pr Co; gen arrangement; piping system; cooling system; water systems; switchboard equipment; operation of plt. Jrnl El'y Pr & Gas-8|22|08-113-26. 4p*+, 128-1.5p (Ed)
- 4 Htg of vtd & enclosed motors; radiation; vtn. Abs. WHartnell & dis. (Inst. of El'l Egrs, Leeds, Eng.) Electrician-8|21|08-724-3p+
- 5 Storage batteries, their constrn & uses. PR Moses. Eng'g Mag.-9|08|843-13.9p*+
- 6 Distribution. Alternating Current. A-C underground distbn. Part II Equipment of Elizabeth St sub-station, N.Y: transformer installations; total operating efficiency of system. SDSprong. Gen Elec Rev-9|08-99-9.9p*

Steam and Gas Engines. (See also 18)

- 7 A note on condensation. 1. Extraction of air from condensers; wet and dry air pumps. Maurice Leblanc. (Trans, Ass'n Technique Maritime, Paris); comparative requirements for turbine & piston engines. Eng'g-8|28|08-287-4.6p+
- 8 Alcohol as a fuel for internal combustion engines (cont'd); alcohol & gasoline compared; necessary changes in design to adapt alcohol to gen use as a combustion-motor fuel; advantages gained. Thos L White. Eng'r'g Mag-9|08-872-10.9p+

Railway Affairs. (See also 20, 21, 23, 25)

- 9 Some causes which tend toward the fracture of steel rails. JEHoward & disc. Jrnl Assn Egrg Soc-7|08|14-31.5p*
- 10 Inspection & overhauling system of records on the surface lines in Brooklyn. I. JLIingoldsby. Elec Tract'n W'kly-8|29|08-863-4.5p+
- 11 St ry system of San Francisco; map of system in 1908, showing converted to ely since fire; history of rapid transit; earthquake & fire; reconstruction by United Rys; el pr stations; other systems of pr supply; rolling stock. JCLathrop. Elec Ry Jrnl-9|5|08-574-8.3p*+. 569-0.4c (Ed)
- 12 El ry egrg-VII-Selection of car equipment. FEWynne. Elec Jrnl-8|08-438-9.8p+
- 13 Theory of rr rates II. Expenditures in relation to expansion of traffic; joint expenditures; the law of increasing returns. WmZ Ripley. RR Age Gazette-9|4|08-857-3p+

Book Accessions.

- 14 Slow burning or mill constrn; wood vs steel beams; reinforced concrete; pipe & hydrant service. Rept No. 5. Insurance Egrg Experiment Station, under direction Boston Mfrs Mutual Fire Ins Co. Ed 3, 44p, 9x11, illus. (1908). *077. In 7
- 15 The strength of concrete beams. Results of tests of 108 beams. RichardLHumphrey, U S Geol Surv. Bull No. 344-59p, 6x9, illus. 1908. *6874. B 344
- 16 Relative hygienic values of gas & el ltg. SamuelRideal. 132p 7x10. illus. 1908. *0741. R 43
- 17 Standards for gas & el service in Wisconsin; gas & el meters; c p of gas; quality & pressure of gas; imp efficiency; installations. Decision U-21, Wisconsin RR Commn. 34p, 6x9, 1908. *2804. Du 21
- 18 Gas Power; study of the evolution of gas pr; design & constrn of large gas engines in Europe; the application of gas pr to various industries and the rational utilization of low grade fuels. FEJunge. 548p, 6x9, illus. 1908. *0724. J 95
- 19 Geology & mineral resources of the Controller Bay Region, Alaska; coal & petroleum, location & composition. GCMartin. U S Geol Surv. Bull No. 335. 146p, 6x9. illus. maps. 1908. *6874. B 335
- 20 Railway signalling: principles of operation & types of apparatus; interlocking; electric train staff system; block signals; fixed signals. Staff of expert Signal Egrs. 108p, 6x9, 1908. *07126. Sl 2
- 21 Opinions & decisions of the RR comms'n of Wisconsin. Vol I. July 20, 1905-July 31, 1907. 855p, 6x9, 1908. *2804. D V 1.
- 22 American business methods (Down-to-the-minute)...Board of Experts of the Business Man's Magazine. 376p, 6½x10, 1908. *02. B 86.
- 23 Moody's Manual of RRs & Corp'n Securities....9th an number. 1908. LouisWHolschuh, Ed. 2864p, 6½x9½. *6900.025. 1908.
- 24 Rules El Lt & Pr Equipmts: consisting of the "National El'l Code" with explanatory notes. Associated Factory Mut. Fire Ins. Cos. 153p, 5x7½, 1907. *In 7i, 1907.
- 25 First an rept of RR Commn of Wisc. 1907. 754p, 6x9, 1908. *2804. 1907.
- 26 The negotiable instruments law from the draft prepared for the Commrs on uniformity of laws; full text of the law as enacted, with copious annotations. JohnJCrawford. Ed 3, 212p, 6x9, 1908. *03. C 85. 1
- 27 Coal Fields of the U S; Map with text. U S Geol Surv. Scale 105 m. to the inch. 25x34½. 1908. 6874.061.

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STONE & WEBSTER PUBLIC SERVICE JOURNAL

NOVEMBER 1908

EDITORIAL COMMENT

On October 22 a referendum occurred in Cleveland, Ohio, in the matter of the Municipal Traction Company. The earliest news account of the affair read as follows: "After several years' trial of a three cent railroad fare, Cleveland today by a majority referendum vote of 951 decided to discontinue the franchise of the Municipal Traction Company. The outcome may be that the railway property will revert to the original owners and the old five cent fare be reestablished." This is the latest aspect of a situation that has engaged the attention of the whole country for some years. We indicated last month that the referendum was likely to prove a warm affair, the street railway situation being apparently of more absorbing interest than the presidential election itself. Outside of Cleveland the outcome is bound to command wide attention, as there has been a tendency to regard the situation in that city as a test case in municipal ownership of street railway utilities.

* * *

Not the least sensational of the happenings of 1908 is the drought that has held the whole country in its embrace. During October there has been a recurrence of heavy forest fires, notably in Michigan. If the total loss in timber from the fires of 1908 were computed, we should possibly be astounded at the magnitude of the figures. It would probably not take many seasons like the

present to convince the entire community of the need of better forest preservation. What with the woodman's axe and with fire, delay in this matter may, without exaggeration, be said to be dangerous. But forest fires are not the only evil the country has been experiencing. There has been an extraordinary drying up of wells and streams, adversely affecting both domestic and industrial life. Many manufactories have been forced to curtail operations for want of water. If winter sets in in earnest with the ground in anything like its present condition, we may find the consequences far from pleasant next year.

Seventeen Years of Street Railway Growth

It was declared in a recent editorial in the New York Sun that "the future of electric railway systems is beyond prediction. Every year sees them an increasingly important agent in the social and industrial life of the country." The soundness of this assertion is demonstrated by certain statistics which accompany it. We are told, for example, that in 1890 only a little more than 15 per cent. of the total mileage of the street and interurban railway systems of the United States was operated by electricity. There were then 8,123 miles of such lines. The total for 1907 was a little less than 39,000 miles, less than 2 per cent. of which was operated by power other than electric. Cables, steam or animals were used on 6,861 miles of line in 1890. By 1896 only 2,337 miles were so operated, while the figures for last year are 776 miles. Electricity is now used on more than 38,000 miles of street and interurban lines in the United States.

Within ten years the number of cars used on so-called street car lines has increased from 56,772 to 86,204. This is nearly twice the total number of passenger, baggage and mail cars used on the steam railways of the country. Since 1900 there has been an increase of about 11,000 in the total number of cars other than freight cars used on steam railways, and an increase of about 23,000 in the number of cars used on the street car lines. Since 1897 the steam railway system has been increased by about 43,000 miles and the others by about 23,000 miles. The capital stock of the street systems now exceeds \$2,000,000,000, or more than double the capital of all street and interurban lines ten years ago.

Considerable interest attaches to the following: "Using round figures, the trackage of the various sections of the country stands

thus: New England, 5,000 miles; Eastern States, 10,000 miles; Central States, 15,000 miles; Southern States, 2,000 miles; and Western States, 5,000 miles. The capitalization of the New England lines is on a basis of an average of about \$36,000 per mile, as compared with the average of about \$58,000 per mile for the rest of the country. In the group classed as Eastern States capitalization exceeds \$80,000 per mile, while the average for New York State alone is about \$110,000 a mile."

What strikes one most forcibly about these figures is the great disparity between the mileage of the South and West and that of the rest of the country. The South is only at the beginning of its industrial career, consequently it is merely a question of time when its traction mileage is fairly comparable to that of other sections. The future unquestionably holds great things in store for the West. Vast as have been the developments there in the last half century, they mark but the initial stage in the creation of a thickly settled and highly prosperous empire. Astonishing, therefore, as has been the development of street and interurban railway service in the last seventeen years, there is no reason to expect, taking the country as a whole, a permanent curtailment of this development for a great many years. Interurban roads, in particular, seem likely to increase in number faster in the future than in the past.

What America Has to Fear from the Balkan Troubles

Europe has had a great scare the past month—the greatest in a generation at least, and possibly the greatest in several generations. Today the fear of a European war of the first magnitude is less than it was a fortnight ago, but the outlook is not yet all that could be desired,—Europe is bound to remain apprehensive for a long time to come. In the political aspects of the situation we Americans may not feel vitally interested. There are, however, certain economic contingencies which we can scarcely afford to ignore.

It seems permissible, at the moment, to hope that none of the great Powers will be involved in conflict over the Balkan situation; but even if this hope proves well founded, the economic consequences of the agitation of last month are likely to be of no small importance. The alarming feature of the situation is its absolutely

cynical character. A stinging blow has been struck at the inviolability of treaties, which comes near meaning that, for the time being at least, European diplomacy bears a strong resemblance to a community located in an earthquake zone. War or no war, it is more than likely that for a long time to come we shall hear a good deal less about disarmament than we have heard in the last few years. More biting irony could hardly be conceived than is presented in a situation like the present, following close on the heels of a long series of Hague Conferences and Peace Congresses. What we are likely to hear from now on is an incessant demand from all European governments, and possibly from our own government, for ships and forts and all the other appointments of war.

That is a fact not pleasant to contemplate. It has been universally agreed that more capital was being locked up in armaments than was good for the industry of the world. All over Europe there has been a hope that something would occur that would enable the Powers to feel that they could safely cut down their expenditures for militarism. This hope has apparently been shattered.

This means increased taxes throughout Europe. That is itself a matter of consequence. But in addition to the mere fact of providing more money, it is necessary to consider what the economists call the "incidence of taxation"—that is, the particular things to be taxed. We can best illustrate this by assuming a concrete case. Since the first of October there has been a renewed demand for an enlargement of the British navy. But Great Britain has for years, practically ever since the Boer War, been groaning under high taxes, and only recently Parliament has passed an old age pension bill which, it is feared, will impose a severe strain on the Treasury. It will be remembered that since 1903 there has grown up a strong movement in England in favor of a protective tariff. This movement has been heavily defeated at the polls, but what the advocates of the present free trade policy most fear is that the requirements for old age pensions, or increased armaments, or any one or any number of other things, will make a general policy of tariff taxes absolutely necessary for revenue purposes. This, it is easy to see, might, for a while at least, operate powerfully to dislocate capital.

In short, a wide-spread demand for larger armaments would use up a vast amount of capital now available for industry and public improvements. This would mean not only more money spent for unproductive purposes—that is, money that does not earn

any return—but also continued expenditures over a long future, to keep the new armaments up to their initial efficiency and to pay the interest on capital involved in their construction. New loans would be likely to abound, and in order to effect these, the European bankers would have to increase their supplies of gold, which, other things being equal, would be quite apt to impart to the metal a tendency away from the United States. This would lower the reserve capacity of American banks and disqualify them from loaning as freely as in the past. Granted we are taking an extreme view of the situation, yet this is certainly a contingency.

If war should actually occur, the situation would unquestionably be worse than this. The first results might, on the whole, be favorable to this country. Our stock market would perhaps be unfavorably effected for awhile, but on the other hand we might reasonably expect to sell Europe a great quantity of our commodities, foodstuffs, munitions of war, etc. And it might happen that the drafting to the colors of hundreds of thousands of able bodied men, and the actual ravages of armies in the field, would diminish the crops in Europe next season sufficiently to create an extraordinary demand for our agricultural products a year hence. It may be rather futile, however, to discuss such prospects. But speaking more generally, there can be no hesitation in asserting that a big war of any duration would have a most unfortunate effect upon the money market. Just such effect was produced in Europe and America by the Boer War of ten years ago. It took us about five years to feel the result, but it came unmistakably in 1903. Only about two years elapsed between the close of the Manchurian War and the beginning of the industrial depression in which this country now finds itself.

It must appear, therefore, that the people of the United States have a good deal at stake in the situation now confronting Europe. Our interests are bound up with the peaceful settlement of this situation.

SYDNEY — THE PITTSBURG OF THE NORTH

Poets have long sung the charms of the St. Lawrence River, and in these latter days its possibilities as an artery of trade have been widely heralded. This magnificent stream, destined by nature to be the highway of a mighty nation's industry, pours itself into the Atlantic through the great gulf bearing its own name. At the mouth of this gulf lies the picturesque and romantic island of Cape Breton, to the north of which extends a broad strait bounded by the island of Newfoundland. The historic imagination is kindled by the mere mention of these names. It was in this region that that adventurous Venetian, John Cabot, first established Great Britain's claim to a vast section of North America. Here France and England warred for more than a century, and here the raw recruits of New England immortalized themselves under the leadership of the redoubted Pepperell.

The French were quick to grasp the fact that nature had fashioned the island of Cape Breton as one of her great critical points. It was to them the sentinel of their whole empire in America, stretching league upon league up the St. Lawrence. One sees today at Louisburg only a few bomb proofs with their four stone arches, and has scant realization of the fortress once deemed so impregnable. Time was when the French spent twenty-five years and six millions of dollars in fortifying the island of Cape Breton. Why? Because they had a prevision of a mighty empire in the valley of the St. Lawrence. They saw but through a glass darkly, but the vision was enough to cause them to pour out their blood and energy and money. Today, we see more nearly face to face. The task of building that empire has been taken from them and entrusted to a people speaking a language identical with our own, and this people has at last begun to exalt the name of "British North America" among the nations of the earth.

Cape Breton guards the St. Lawrence, and her growth must be commensurate with the growth of the industrial empire traversed by this stream. Nature has left nothing undone to provide

for this. On the east side of the island she has created one of the finest harbors in the world. This expanse of water is nearly two miles wide at its entrance, and four miles from the mouth it divides into two great arms, on one of which is located the city of Sydney. Of Sydney Harbor, one has said: "The day is coming when its broad bosom will bear, secure from the fierce winter storms, the carriers of the nation's commerce, when the skies will be pierced by the funnels of a thousand furnaces." Already the prophecy is well underway to fulfilment.

Sydney, in short, is an exceedingly pleasant town, in a charming country, and is destined to play a great part in the industrial future of North America. It is an attractive place to live in and an inspiring place to work in. In the opening days of 1899 it had a population of 3,500, a quiet sleepy town. But in January, 1901, it sheltered approximately 10,000 souls, and in 1907 the number was 15,000. Evidently, something has happened at Sydney in the last ten years.

But before turning our attention exclusively to the facts of the city's industrial growth, it will be pleasant to linger a moment over those features which make the place appeal to other instincts. As someone has said, the island of Cape Breton is "the Scotch Highlands reproduced in the New World." Here are lakes and glens, hills and mountains, ravines and roaring torrents, and bold ocean promontories beaten by the wild Atlantic. To the east of Sydney lie the lovely Bras d'Or Lakes, which the late Charles Dudley Warner once described as the most beautiful salt water lakes he had ever seen. The largest of these is about one hundred miles long, with a width in some places of ten miles, its undulating shores being dotted with fertile farms. From Sidney you travel south to historic Louisburg, where in 1896 a monument was erected by the Society of Colonial Wars in commemoration of the New England men who effected the first capture of Louisburg. The way to Louisburg lies through a country abounding in charming features. There is the Mira River, with its umbrageous banks and pleasant meadows, and the splendid bathing beach at its mouth. And there are the salmon, trout and whitefish that make its waters alive. Catalone Lake, that placid inlet of the Atlantic, lies dotted with green islands as you look from the car window. And what delightful watering places Big Glace Bay and Cow Bay (or, if you demand a more dignified appellation, Port Morien) are destined to become!

A wild romantic country awaits him who journeys north from Sydney. The east shore of Victoria County is accounted "The Norseland of the New World," featured by towering headlands, deep dark fjords, and virgin forests. Behind lie great tablelands, a secluded region of deep ravines, extensive glens and rushing watercourses. It is preeminently a sportsman's land, frequented by great herds of caribou, and abounding in streams alive with trout and salmon.

If, physically, Cape Breton is a new-world reproduction of the Scotch Highlands, so is it also in its human aspects. Its stock is that of the Scotch Highlands, of the men who fought at Culloden. Scotch thrift, Scotch shrewdness, and Scotch perseverance are the characteristics of its people. It is not until the last fifteen years that these qualities have found opportunity for their freest exercise; the opportunity occasioned by that series of industrial exploitations which began with the creation of the Dominion Coal Company has not been unimproved by the people of the island.

The influx of foreign capital has done great things for Cape Breton. In 1893 the Dominion Coal Company was organized—it has now an outstanding capitalization of \$23,000,000—for the purpose of developing the mining properties in the vicinity of Glace Bay. Certain Boston and Montreal capitalists, notably Mr. Henry M. Whitney, Lord Strathcona, Sir William C. Van Horne and Mr. W. B. Ross, saw the great possibilities that existed of enlarging the market for Cape Breton coal. Through their means extensive contracts for the use of this coal were made in the United States. The great New England Gas & Coke Company at Everett, Mass., for example, owes its origin largely to the opportunity thus furnished to obtain an unlimited supply of low priced raw material. The Cape Breton coal fields are practically inexhaustible. The new capital has transformed that part of the island.

Following the new development of the coal fields came the creation of the Dominion Iron & Steel Company at Sydney. This plant employs three thousand men, with an average monthly pay roll of \$175,000. In 1906 (a representative year) it produced 210,117 tons of pig iron, 235,311 tons of steel, 2,111 tons of sulphate of ammonia, and 3,727,136 gallons of coal tar. Here we have the basis for a splendid industrial centre. To the creation of the Dominion Iron & Steel Company may be traced the sudden jump in the population of Sydney at the beginning of the twentieth century, and the fact also that the city has acquired through-



out the continent the title of "The Pittsburg of the North," The works of the company are divided from the town by a narrow creek, and consist of four blast furnaces, with a total capacity of 1,400 tons of steel per day, open hearth furnaces, a billet mill, blooming mill, rod mill, and machine shops. Back of these works, which extend two miles along the creek, are coke ovens. The ore is obtained from Newfoundland, and the coal from the beds of the Dominion Coal Company, the limestone being also a Cape Breton product. It can easily be seen that the company could not be more admirably located with respect to its raw material.

In addition to the steel works, we find at Sydney a cement plant with an extensive output, a tar and chemical company, tar paper works, iron and brass foundries, wood factories, railroad repair shops, tanning establishments and the shipping piers of the Dominion Coal Company. The city is the eastern terminus of the Intercolonial Railway, and is also the terminus of the Sydney & Louisburg Railway. The status of Sydney as a shipping port is shown by the fact that for the nine months ended March 31, 1907, vessels to the number of 1158, of 924,536 tonnage, arrived and departed.

These interests, with those at Glace Bay (where the Dominion Coal Company employs sixty-five to seventy-five hundred men, with a monthly payroll ranging from \$260,000 to \$360,000), attest Sydney's claim to a large place in the industrial future of North America.

A word must also be said about North Sydney which lies five miles down the harbor, in close proximity to the Sydney mines of the Nova Scotia Steel & Iron Company. This company employs nearly three thousand men, and dispenses \$120,000 in monthly wages.

Sydney is naturally the social, wholesale and shopping centre for a great industrial community, the monthly wages distributed in and around it being estimated at three quarters of a million dollars. The commercial streets have been filling up with substantial business blocks, and attractive residential thoroughfares have been climbing up the back slopes of the harbor.

The facts recounted above show quite clearly why Sydney has proved an attractive field for the activities of the Stone & Webster organization. It was in 1901 that Stone & Webster entered the field. Up to that time the community was without street railway facilities. There was in operation an electric light plant, which,

on being entrusted to the management of Stone & Webster, became the starting point for the Cape Breton Electric Company, Limited, the northernmost of the Stone & Webster companies.

Today the Cape Breton Electric Company, Limited, does the entire lighting business in Sydney and North Sydney; it operates the street railway in Sydney and an interurban road between North Sydney and Sydney Mines; it does the entire ferry business between Sydney and North Sydney; it owns one-half the stock and bonds of the Sydney & Glace Bay Railroad Company, Limited, which operates an interurban line between Sydney and Glace Bay. The Cape Breton Electric Company, Limited, has in operation twelve miles of track, while the Sydney & Glace Bay Company operates nineteen miles, all laid with 60 lb. T. rail. The latter company has running rights over the Cape Breton Electric Company's tracks in the city of Sydney. These two companies are equipped with cars, ploughs and sweepers to conduct transportation in accordance with approved methods.

The principal power station is located at Sydney, with a capacity of 1200 Kw. The equipment is of the most modern type, and the station supplies electric light for the city of Sydney and power for the local railways, including the Sydney & Glace Bay line, which has a long term contract with the Cape Breton Company. The latter also owned a station at North Sydney, which supplied power for North Sydney and Sydney Mines. In the last year, however, a transmission line has been erected between the Sydney and North Sydney stations, which has done away with the generating of current at North Sydney.

The Cape Breton Company is the owner of three ferry boats and an excellent wharf and warehouse at Sydney, besides owning unrestricted wharfage rights on two piers at North Sydney.

Such are the conditions which have been created in and around Sydney in the course of only a few years. Here is a community with thirteen prosperous banks, designed by nature as a natural halting place on what is to be one of the greatest industrial highways of the future, and possessing at present extensive commercial relations not only with the St. Lawrence valley, but also with the United States and the West Indies.

WATER FOR STEAM BOILERS

By T. A. MIGHILL, Ph. D.*

Water for purposes of steam generation is generally obtained from three sources, lakes, rivers and wells. The purity of the water is affected by the mineral and organic matter which it contains. The water from lakes is the purest, for it accumulates from rain and shallow springs. Water from small ponds, especially in woody localities, where leaves are carried into it from brooks, or where the shores are marshy, is apt to contain considerable organic matter. River water varies in purity with the season, containing more or less mud in suspension in spring time and more organic matter in the fall. Rivers are also more or less polluted with sewage. The water from wells varies widely with the locality and depth of the well, but is apt to be low in organic matter and high in mineral matter. Spring water coming from considerable depths may contain enough foreign matter to render it unfit for use. In some localities subterranean water is impregnated with gaseous compounds of sulphur, which are very harmful to iron boilers and which should not be used.

All natural water contains oxygen and carbonic acid gases, both of which have a rusting effect upon iron. These vary widely in different waters, the oxygen being less where there is much organic matter. Carbonic acid occurs to some extent in water containing organic matter as an oxidation product. It is found much more, however, in subterranean waters which have percolated through regions where limestone abounds.

The organic matter is the soluble portions extracted from vegetable matter and the products of oxidation and decomposition, and contains complex compounds known as humic and ulmic acids.

The mineral matter contained in water is generally one or more of the following substances:—calcium sulphate, magnesium sulphate or chloride, acid calcium carbonate or acid magnesium car-

* Of the Stone & Webster Laboratory.

bonate, sodium chloride, acid carbonate of iron or colloidal basic compounds of iron. Sometimes the sulphates of iron, aluminum or even copper are met.

The effect of water upon boilers is two-fold; first oxidation or rusting and second incrustation or formation of scale. The process of rusting is somewhat obscure in its first stages but the final stage is the formation of iron hydroxide through the oxygen present in the water. Carbonic acid hastens the process. The latest theory of the rusting of iron finds its basis in the iron itself. Commercial iron is really quite a complex substance, containing quite a number of elementary substances combined in various ways and not perfectly uniformly distributed. These portions exert a different solution pressure upon the water, whereby a small but sufficient difference of electrical potential is established, with the result that certain portions of the iron enter into solution as from the anode of an electrolytic cell and are subsequently oxidized by the oxygen present with the precipitation of oxides of iron or rust.

The analysis of the mineral matter in solution in water is properly a matter for the chemist, but certain information can be obtained by those who wish to determine the character of the water they are using or contemplating to use. In some portions of the western states alkaline waters are found which feel soft to the hands and deposit silica on evaporation becoming caustic thereby. These waters give a pink color to phenolphthalein. But the majority of waters containing mineral matter in solution are hard and do not easily give a foam with soap. These waters contain a variety of compounds. If near the sea they may be brackish from infiltrating sea water and contain considerable quantities of sodium chloride, which can often be detected by the taste. However, it is the presence of the elements calcium and magnesium, combined with sulphuric or carbonic acid which causes the most trouble and whose presence is to be determined. The presence of combined sulphuric acid may be inferred by the white turbidity or even a precipitate formed by adding a few drops of a solution of chloride of barium to the water. Carbonic acid escapes on boiling the water and the magnesium or calcium carbonates held in solution by the presence of the excess of carbonic acid are deposited as a turbidity or a precipitate. The presence of calcium may be inferred by the formation of a white turbidity by the addition of a solution of sodium carbonate (sal soda). If this fails a few drops of a solution of ammonium oxalate will give a white precipitate. The pres-

ence of magnesium can only be determined after the removal of the calcium. The test should be made as follows:—Dissolve a half a spoonful of sal ammoniac in a half a cupful of the water and add a few drops of a solution of sodium carbonate, allow to stand a day and carefully pour off the clear water from any deposit, then add a spoonful of ammonia water and a few drops of a solution of sodium phosphate to the clear liquid. If, after standing several hours, a turbidity or a precipitate forms magnesium is probably present.

The presence of chlorine may be inferred by adding a little pure nitric acid to the water and then a few drops of a solution of silver nitrate. The immediate clouding of the water will indicate the presence of chlorine. The presence of iron may be established by the blue color obtained by adding a few drops of a solution of ferro-cyanide of potassium to the water.

If the presence of calcium and sulphuric acid or magnesium and chlorine or all four be found the water will undoubtedly produce scale or corrode the boiler.

Scale is generally a deposited sulphate of calcium which becomes compact and clings very tenaciously to the tubes. It is a rather soft substance and can be knocked or scraped off. It is caused by the property that calcium sulphate has of being almost insoluble in water when heated to the temperature of water in a steam boiler. It drags down and incrusts any deposited calcium or magnesium carbonates, which thus add to the scale, though by themselves they would deposit loosely.

A deposit in the boiler less tenacious, and which can be blown off, is formed by sediment in the water and the carbonates of calcium and magnesium alone, oxides of iron and organic matter.

The corrosive agents are compounds of sulphur, carbonic acid and the chlorides of calcium and magnesium. Water should be avoided entirely if compounds of sulphur be present. In some regions near copper mines the water may contain copper in solution. Such water will dissolve iron, and waters containing the higher sulphate of iron would have a similar action. But these are exceptional. The chloride of magnesium is the most dangerous ingredient of ordinary waters, for it decomposes on heating, as do most of the salts of magnesium, and hydrochloric acid is liberated which attacks the iron. Calcium chloride has a similar though feebler action.

When possible unsuitable waters should be avoided; but if such is impracticable, the water may be improved by some suitable treat-

ment, dependent upon the character of the water and the expense attendant thereto.

Preheating of the water by waste flue gases or waste steam or other methods will largely remove the carbonates of calcium and magnesium, but not the sulphates or chlorides. The addition of sodium carbonate (soda ash) to the cold water will unite with the free carbonic acid to form acid sodium carbonate, and the calcium or magnesium carbonate will be deposited, but the acid sodium carbonate will be decomposed again in the boiler and the carbonic acid liberated with more or less injurious effect. The addition of sodium carbonate to water containing only calcium sulphate will deposit the calcium as carbonate and leave harmless sodium sulphate in solution. It will act much the same with water containing magnesium chloride or sulphate.

Lime water or milk of lime is good to add to deposit the carbonates of calcium and magnesium by uniting with the excess carbonic acid, but it will not remove calcium sulphate. More costly, but better, is the addition of caustic soda, which will unite with the excess of carbonic acid, free the calcium carbonate and precipitate much of the sulphate of calcium as calcium hydrate and carbonate. It also decomposes the acid carbonate of magnesium, but acts very slowly upon the sulphate or chloride of magnesium.

The sulphates of calcium and magnesium can be entirely destroyed by adding barium chloride to the water, the sulphuric acid being deposited as insoluble barium sulphate. This leaves the calcium and magnesium as chlorides, which are bad on account of the corrosive properties of these substances. This could be avoided by using the more expensive caustic baryta, which would remove the sulphuric acid as barium sulphate and the calcium and magnesium, to a considerable extent, as hydroxides and introduce no chlorine into the solution.

The use of the rather expensive trisodic phosphate has been recommended to remove the magnesium and calcium, and this is probably good for the purpose. Magnesium phosphate has a tendency to adhere to rough or scratched places, but the method is said to work very well.

These purifiers are sometimes added in the boiler, being pumped in slowly in solution. By this method all the precipitated matter has to be removed from the boiler, but it does away with purifying tanks. Other substances as oak wood, tan bark, sugar, molasses, dextrine, graphite and tallow, potatoes, paraffin oil, are

sometimes added inside the boiler where they act upon the scale by the solvent action of the acid products formed by their decomposition, though these same products may attack the iron.

Fatty oils should not be allowed to enter into the boiler, for they are decomposed by the hot water and the freed stearic acid attacks iron.

The addition of potassium chromate or bichromate has been lately recommended to prevent the corrosion of the iron. It has been found that these substances will protect iron, and the theory is that the iron dissolves oxygen from these oxidizing agents, which makes it, as it were, an oxygen electrode and prevents its passing into solution. These substances, however, have an oxidizing action on organic matter and might form acids which would be injurious to the iron.

A very satisfactory method of treating water containing much organic matter is to add a sufficient amount of alum to the water and an equivalent amount of soda, which will precipitate the alumina which will drag down the organic matter with it.

The above remarks upon the treatment of water are suggestions rather than detailed information for procedure, and interested readers are referred to the literature of the subject for further information.

THE PURPOSES OF PUBLICITY

The purposes of publicity can only be treated here, briefly. It is only wished to define, in a general way, these purposes and to attempt to remove the subject out of the cloud in which it rests in the minds of most men.

Publicity, in the sense of being the public statements of a corporation or individual, is often looked upon with suspicion. It is useless to say that there is no reason for this. There is a reason. And the reason is, that we, in this country have seen already a good deal of misrepresentation in corporation publicity and in connection with it, a good deal of the attempted corruption of the news columns of the press. It was not intended that we should see it but we have seen it. And the very fact that we have seen it so easily, shows how futile is the publicity of misrepresentation and the underground method of corrupting news. Sooner or later and usually at once, the public scents the truth and a feeling against the corporation or individual who has indulged in these methods is born or doubled. Such publicity is poor policy. And even though some will argue this last, nothing could be plainer than the fact that such publicity is a brazen offence against decent ethics.

So said a man in the seat in front on a suburban train going toward the city. It was when a public service corporation was endeavoring to accomplish something with popular feeling and a large daily newspaper contained on its front page two columns of "news" which was as obviously paid matter as any that has ever been printed. The man pointed to it. "I had some sympathy with that company," said he, "but it's plain enough that if they are fighting with these kind of weapons their ends are probably bad. This fixes me and I'll never buy another copy of this sheet again." There is no doubt whatever that this particular "news" story lost the corporation many a friend and that it would have been worth a good many times what was paid for the advertisement

to have kept it out. Many a corporation management has learned this lesson even though comparatively few men who are willing to go into dishonest or underground publicity have any adequate idea of how much harm may come to them because of their choice of method. No one could be foolish enough to contend that it is impossible to fool the public. For it is occasionally possible. But when the public finds out, it is rightly angry and, probably rightly, revengeful. The report of the Interstate Commerce Commission in which it was stated that the Standard Oil Company, or one of its agents, was "using" the news columns of newspapers, created more feeling against this corporation than twenty magazine articles can repair. And on the whole this kind of publicity is a poor risk and in some cases bondholders ought to prevent it on the ground that it impairs their security.

With the elimination of the question of the dishonest purpose or method of publicity it will now be possible to speak of the work and good which may be hoped will proceed from "straight" publicity when publicity by a public service corporation is advisable.

After all, the real target which this publicity aims at is understanding. People within a decade have learned to want an understanding of public questions. They are willing to go to some trouble to get their understanding but unfortunately all American life is so complicated that they generally acquire only that little knowledge which "is a dangerous thing." So, beyond going out after understanding, they are anxious that understanding shall be brought to them. And when it is brought to them they are grateful for it just as the people of New York are grateful to Mr. Hughes who as Governor of the state brought state issues to the people and made them understand. Mr. Hughes, in other words performed what will in the near future be rightly regarded as one of the chief and most valuable functions of an executive—the clarification and publicity of governmental issues.

No doubt the affairs of a public service corporation are not so public a matter as a state or city government but they are considered by the public itself as more a public matter than most corporation managers usually are willing to believe. The public has this idea and incidentally have discovered within a short time, that there are ways of insisting upon their interest.

This has frightened public service corporations very much at times. It has upset the old idea of secretiveness. And there are plenty of executives to be found today who stand in terror of the

disclosure of facts which are as harmless as can be. These men forget that a large part of the distrust of public service corporations grew out of a hushing, secretive, wary attitude and that this attitude was the real cause of most of the distrust. The public's suspicion is aroused by any semi-public corporation which seems to run its business in a cellar no matter how uprightly and honestly and faithfully that semi-public business is conducted. When the public really looks into the matter the surprising thing is not how unreasonable is the public. The surprising thing is how fair is the public! When the corporation comes out into the sunlight the public is surprised to find that it is not the monster that the yellow agitators would paint it. And on the other hand the corporation is usually surprised to find that the public lets its face relax into the rather sheepish expression of one who has planned to do a very radical thing and suddenly sees that no necessity exists for doing it.

Just as the public is grateful toward the executive who brings to it understanding of public questions, so also is the public grateful to the semi-public executive who brings to it understanding of semi-public questions. And it is this underlying function and purpose of all public service corporation publicity which the writer wishes to emphasize again and again.

To be concrete, let us suppose that public sentiment is beginning to condemn a steam railroad on account of the number of accidents. The railroad by pamphlet or newspaper advertisement states the facts about its endeavors to prevent accident. For instance, it makes a statement about how it systematically trains its employees to guard against mishaps. The public is glad to know that the railroad employees are trained. Sentiment against the railroad is undoubtedly softened. But let no one forget that the accomplishment of this publicity is two-fold. Directly it told the public a fact which the public should know. Indirectly it told the public that the corporation was willing to go out of its way to tell the fact—to bring understanding to the public. And probably this second accomplishment did more for the cause of intelligence and fairness than the first.

But a correction is here needed. The accomplishment was not two-fold; it was three-fold. For there was another effect of this advertisement—a very important, though often forgotten, effect.

The third effect of this advertisement was to tend to humanize the corporation. And the more anyone thinks of it the more they

will be obliged to agree that this purpose of publicity is highly important.

There is a great advantage gained in the relations between a public service corporation and the public if there can be given to the corporation a personality. No one can have any friendship toward a company itself. You cannot work up much fairness toward a corporation charter and a contract and a lot of cars or gas pipes and an indefinite lot of stockholders who are mere names. Men who will be fair and reasonable with men take no great interest in being fair to things. A corporation as a thing invites no great measure of friendship or loyalty or even fairness but a manager of a corporation or the group of men who manage it are men. It is to this man or men that the public's good will and desire for understanding go forth. And when the public begins to talk about the corporation as a particular group of men who operate a decent business and tell the truth and have no fear and make no truckling apologies, then begins the opportunity for the best relations between the public and the public service corporation.

Publicity—the public statements of a corporation,—helps toward the establishment of this corporation personality. It humanizes the business. Things do not make statements; statements are made by men, and with men we can have some sympathy.

To sum up briefly the purposes of publicity can be, first, to communicate a fact or facts about a semi-public business. Secondly, in all cases to show at least a fair amount of deference to the public's desire to understand and, third, to establish a personality. There are few instances where publicity is used, that do not open an opportunity to all three purposes.

It does not follow that a corporation must use publicity all the time. It does follow, however, that there are occasions when publicity will accomplish an understanding which could be accomplished in no other way. It does not follow that a corporation must keep talking all the time, but it does follow that both the public and the public service company mutually benefit occasionally by an exchange of facts and ideas. Particularly it is worth considering that, when the question uppermost is properly a concern of the public, knowledge should be given the public. A corporation as a thing would be silent, a corporation as a group of men would have an utterance. And the public wants to deal not with a thing but with men.

THE HAUSER LAKE AND WOLF CREEK PROJECTS

The region of the upper Missouri River near Helena, Montana, presents exceptional opportunities for water power enterprises. Flowing abundantly in a deep bed between precipitous hills and dropping down from the mountains, the river itself seems to invite development, while to the south and southwest, within easy range of high tension transmission, the greatest collection of mining properties on the continent affords a market for power. Helena, Butte and Anaconda, with their mines and smelters using enormous blocks of power where fuel is very dear, are all within the zone.

Very natural it is, then, to find that the situation was among the first in this country to engage the practical working interest of large capital in water power development. The work began in 1896, almost at the inception of the era of long distance transmission of electrical power, after the Federal Government, at the instance of the Helena Board of Trade, had conducted investigations and declared the Missouri River unnavigable above Great Falls, Montana. This made permissible damming of the river and the storage of its waters.

The first plant was built at Canyon Ferry, 17 miles northeast of Helena. It was completed in 1898 and has been in operation regularly since that time, at first supplying power only to Helena and vicinity. The capacity of this plant is 9000 HP, the dam being 470 feet long and 40 feet in height.

At Hauser Lake, 16 miles below Canyon Ferry and 18 miles from Helena, a second installation was completed in 1907. This original Hauser Lake development consisted of a steel frame, steel plate and masonry dam, 70 feet high and 630 feet long, with a power house of 14,000 Kw. capacity. The height of the dam was increased several feet by the use of flash boards. The lake impounded had an area of ten square miles and was named after Ex-Governor S. T. Hauser, of Montana, who has been from the



first a leading figure in the projects under consideration in this article. The power house at Hauser Lake contains five pairs of horizontal turbines, direct connected to 2400 volt Westinghouse generators having a capacity each of 2800 Kw. The transformer capacity of this power house is 18,000 Kw. and the transmission potential is 60,000 volts.

On April 16th of this year, the center of the Hauser Lake Dam went out. The end sections of the dam, about 150 feet on either bank, held so that the flow of water was confined to the center of the river and the power plant just below was only superficially damaged.

Negotiations for the reconstruction of the dam were immediately commenced with construction firms in the East and on July 11th the Stone & Webster Engineering Corporation was selected to do the work on the "cost plus a fixed sum" basis. On July 28th the work of rebuilding was actively commenced.

Living accommodations for a considerable construction force have been built and equipped with a water supply system; scows for the pile drivers and diamond drill have been constructed, and new roads have been made and old roads remade for the transportation of steam shovels and locomotives. An electric power plant and lighting system is under construction, and arc and incandescent lighting will be supplied for night work. The construction equipment on the ground includes rock crushing and cement plants, five sets of derricks with hoisting engines and boilers, a 40 ton traction steam shovel and six carloads of lesser plant. Shipment has been ordered of a traction engine with six steel trucks, two narrow gauge locomotives and 50 dump cars. An order of two million feet of timber for the cofferdam is being delivered at East Helena to be floated down to the dam site, while an initial order for cement, amounting to one hundred thousand barrels, has been given.

The most important single event yet occurring has been the location by diamond drill borings of foundation rock for the new dam at comparatively easy working depth, whereas the greatest fear had existed of holes that would make the construction very costly. The plans for the dam have not yet been completed, but the remaining parts of the old dam are being entirely dismantled.

The processes of mining and refining ores to which electrical power is particularly adapted, and which have caused the demand continually to outdistance the capacity of the plants on the Mis-

souri, are very numerous. Among these uses especially to be noted are the driving of the air compressing machinery for the mine drills, the operation of the mine pumps and the operation of the concentrating machinery. Altogether, the scale upon which the consumption of power in mining operations is graded is tremendous. It may be appreciated in some degree when it is noted that a single property, the Washoe smelter at Anaconda, is equipped with 13,000 HP of motors, which are subject to an average load of 8000 HP.

A further step in the development of the Missouri River is the plan for the Wolf Creek installation, the site of which is about 24 miles below Hauser Lake. The dam will be 1800 feet long and 110 feet high and 30,000 HP will be developed, a capacity nearly equal to the aggregate of the Canyon Ferry and Hauser Lake plants. Arrangements for this greater work have been carried along with the preliminaries of the Hauser Lake work, and the task will also be in the hands of the Engineering Corporation. A start has been made by the building of a spur from the tracks of the Great Northern Railroad to the site of the dam.



THE RETURN OF AN OLD FRIEND

At the request of several in the office, who have been here for a number of years, Honorable Cameron Forbes, now Vice-Governor of the Philippine Islands, but better known some years ago in this office as "Cam," very kindly gave an informal talk to all in the Stone & Webster building on Oct. 5. All were invited and all attended, in the securities department on the first floor at five o'clock, when the day's work was over.

Mr. Webster welcomed Mr. Forbes and referred to the great regret of the firm when he left. Such part of Mr. Forbes' remarks as the stenographers could take down is given below. As he spoke entirely without notes, it was impossible to reproduce all he said.

I think that my active business career was started under the direction of Messrs. Stone and Webster. They were the guiders of my infant mind and led me in the paths of dollars and cents.

I never knew exactly why they took me on, except that they had a total force of thirteen members and I think they were superstitious enough to believe that they would not succeed with so unlucky a number, and so had to make it fourteen in some way or other, and so suggested that I come in. I worked with them, as Mr. Webster has said, for five years, being pulled from above by Messrs. Stone and Webster and pushed from below by Mr. Tripp, who was taken on ostensibly to assist me, but really to show me how to do my work. I was put in charge of the accounting department as they called it. I did not know very much about accounting, as they found out very quickly, and so they found it advisable to get Mr. Tripp, who also steered the financial department; but I do not suppose any of you who know the organization here have ever heard of the financial department. Well I was "it." The financial department stands before you. When I resigned, the financial department went out of existence. It was composed of one member. All the rest of the departments of Stone & Webster had stenographers and assistants and all kinds of things, but the financial department stood alone. It was created to give me

some kind of a standing in the office. I received a promotion during the course of my stay, after about three years, I think. This promoted me to having a red carpet in my office. It did not carry any additional pay, but it carried a little additional dignity. It pleased me and incidentally did not hurt the firm. The original expense was not very heavy—we figured that out very nicely in the accounting department—and the annual expense afterward was almost nothing.

It is a curious coincidence—in view of later events—that shortly after I resigned from my important position with Stone & Webster—and I think I may say the resignation was for their good—I got a telegram from Mr. Webster asking me if I would go out to the Philippines and take up the organization of the electric railroad there in Manila. I did not feel entirely free at that time and telegraphed back that I could not do it.

I want to tell you something which I think will be interesting to you all, and that is how the experience which I got here in Boston under the guidance of those who are now your chiefs has had its influence on the Philippine Islands. I think the organization of Stone & Webster has had a direct, and in some respects an almost controlling influence on the organization of the Government in Manila. It seems a long way from a small office—not so awfully small now either—in Boston to the administration of seven or eight millions of people in the Orient.

I used as my pattern, for all that part of the re-organization which I suggested, the organization which I had seen put into effect here and of which I had always been a part, and my mind could not help traveling back to a committee which was appointed by Mr. Webster and Mr. Stone which we called the "Committee of Internal Communications," I think in order to give ourselves a name in the office, by means of which we tried to analyze the organization of the office here in Boston. It was at that time located at No. 4 Post Office Square. We suggested all kinds of things which proved to be not very useful and were changed after a month or two of trial, or as the office grew bigger.

One day I happened to remember that Mr. Stone liked to have pictures to illustrate his reports, so I found a picture of a log cabin somewhere and put it at the beginning of a report with the words under it, "The House Where Russell Robb Was Born"—Russell Robb being the other member of the committee.

I found that to organize an accounting department in the Phil-

ippines was a good deal of a job, as, in the first place, although I knew enough about accounting to know that their system was bad, I did not know enough about it to tell them how to make it right. I knew, however, that Mr. Tripp could tell them all about it, and I went to the Governor General and told him that I knew of one man in the United States who could, I knew, set the whole thing straight if we could only get him out there. He said "we will do it," and we sent a cable to Messrs. Stone & Webster asking them if they could spare Mr. Tripp to come out to the Philippines and tell us how to manage our accounts.

Messrs. Stone & Webster sent back a very sympathetic message and explained that Mr. Tripp was making more money for them here than he could possibly save for us there, and that much as they sympathized with our desire to save money they sympathized still more with their own desire and could not spare him to us, as they needed him to make money for them here. In which they were perfectly right.

Then I came back here and went to see the Secretary of War, who was then Mr. Taft, and told him all about it. He said that he would like to see that man Tripp. I telegraphed for him and he came on to Washington, and the Secretary looked him over and he looked the Secretary over.

We sat down and worked out a scheme for re-organizing the accounting system in Manila on a new basis. I had a long conference with Mr. Tripp and Mr. A. S. Pratt, who very kindly lent us the use of his gray matter for several days.

I remember when the Annual Book came out which Stone & Webster sent me—about the first of March. It had the names and data from all of the companies up to the 30th of December, and considering the time it takes to get the information in from the companies, it looked as if it had been prepared over night. I took that book in to the Governor General, who looked it over, and I showed him the number of companies interested and the size of the figures involved and how picayune his figures were in comparison with the dollars and cents handled by Stone & Webster.

I have dwelt on this to a considerable length, as I thought it would interest you all to know how far reaching you all are.

I have got a sample here which may go to show you the method of doing business in the government service in the Philippines. It is done by endorsement. The person issuing a paper respectfully endorses it to the Honorable So-and-So, and it goes on

from department to department, down from the head of this department and then to the head of the bureau and then to the head of a division and then up to the fellow who is interested in the thing, and has to come back through other channels—"pass the buck," as it is called—and you sometimes see a paper with thirty or forty endorsements on it. The system is a good one because it has the record complete. It is bad because it gives one an opportunity to pass the responsibility on to some one else; that is, to send it on to some one else for an opinion or something of that kind.

Here is a case which is rather amusing:

[Referring to his colleague, the Chief of Constabulary, Mr. Forbes here read a legal document bearing about twelve endorsements from one official to another. The paper proved to be a complaint that some old guns were at that time in the public square and unprotected, and it was thought by the person writing the notice that these should be removed to a place of safety as a precaution against the possibility of the natives getting hold of them and using them as firearms in case of a riot or uprising of any kind. After the document had been endorsed five times, the sixth endorsement read to the effect that he had investigated the offending *guns* and found them to be the remains of some old sanitary *pumps* which had been used by the commission for previous cleaning of the city sewerage system. It was suggested by this endorser that the *pumps* if used by the natives in an effective manner as *guns* would cause some consternation, but probably no particular harm to the American citizens.]

I found the men out there, on the whole, to be a very good lot of capable men. They were fellows who had not been brought up with a business training. They have not had the advantage that you men have of being in an organization that goes ahead all the time, but they were tied up with red tape and were inexperienced in slashing ahead or in business methods; but they were hard working, earnest, clean-cut men and meant to do right by the service—the men who did not were the exception to the rule. All through the American service in the Philippines you will find men who work not by the whistle but by the job, and they stay by the job until it is done. I had an opportunity to find that out while I was looking over the reorganization, by looking up the overtime hours worked in each bureau. It is something perfectly astounding, the amount of overtime work done; and in that service there is no pay for overtime work.

ORGANIZATION OF THE ACCOUNTING DEPARTMENT OF AN ELECTRIC RAILWAY AND LIGHT COMPANY

By A. R. PATTERSON.*

Through my connection with the auditing department of the Stone & Webster Management Association, an association which has the general management of electric light, power and railway companies of varying sizes, in different parts of the country, it has been possible for me to choose, for the purposes of this paper, a company which, in my judgment, reflects the requirements of the greatest number.

A brief outline of the company to be treated with is as follows:

Annual gross earnings, railway department..\$450,000.00

Annual gross earnings, light and power department 350,000.00

Total annual gross earnings.....\$800,000.00

Population served 70,000

Miles of single track 65

Cars operated 45

Light and power customers 4,000

Number of employees 300

Length of time company has operated..... 10 years

The man in active charge of the accounting department is herein given the title of assistant treasurer, in recognition of the fact that the treasurer is usually a man of larger responsibilities in the financial world, and in addition to his interest in the railway and light company, is probably identified with other enterprises in the city, and, therefore, can give little time to detail work. With this explanation, the following plan of organization is submitted, the figures representing the monthly rate of salary:

Assistant treasurer\$200.00

Chief clerk 100.00

Storekeeper 75.00

Storeroom porter 45.00

*Auditing Department, Stone & Webster Management Association.

Line order and billing clerk, light and power department	75.00
Customer's ledger clerk, light and power department	75.00
Two collectors, light and power department:	
One at	75.00
One at	65.00
Voucher and payroll clerk	70.00
Two meter readers, each	65.00
Cashier, light and power department.....	65.00
Conductors' trip-sheet clerk	80.00
Railway cashier	65.00
Car register reader, etc.....	60.00
Transfer and ticket checker.....	30.00
Stenographer	55.00
Office boy	15.00

A summary of the above office force will give a total payroll of \$1,280 a month, a trifle under 2 per cent of the gross earnings.

Having given titles to the various office employees, it is now in order to describe the principal work allotted to each one.

ASSISTANT TREASURER.

A salary of \$200 per month should attract a man whose make-up should include the following qualifications: Integrity, respectability, cordiality, ability to intelligently open up or close a general set of books, especially in connection with a consolidation or reorganization of companies; impartial treatment of capable clerks and a desire to apply civil-service rules, encouraging each clerk, in a proper way, to learn the work of the man next above him. To do this, the assistant treasurer must educate each man to voluntarily come to him for other work when his regular duties are done, and each clerk should be made to see the advantage to be gained by gladly undertaking any line of work which he may be asked to do, whether his regular work may be finished or not.

Such an assistant treasurer should command the respect of all, especially the general manager. Hearty co-operation between these officials is frequently the means of bringing about increases in earnings and reductions in expenditures. Conferences entered into, in the right spirit, between the general manager and the assistant treasurer become a habit. Then it is easy to arrange for conferences at stated periods, say twice each week, or more frequently, if neces-

nary. At such times the assistant treasurer will give the results of his studies along the following principal lines:

Comparison of daily analysis of railway earnings. This will sometimes furnish a barometer indicating a leakage on certain routes to which two or more conductors are assigned. Sometimes, through a transfer of men on a certain run, a new man turns in each day several dollars more than the old man, or possibly several dollars less. The comparison is of interest either way.

In the customers' ledger it may be noticed that certain large light or power customers show decreases in their monthly charge. This may be attributable to meters running slow.

In the miscellaneous accounts receivable ledger it may be noted that no bill has been made against the junk man for two or three months. Possibly the scrap copper, brass, etc., may have got into the wrong channel.

An examination of supplies issued or returned slips may reveal the fact that too many car brasses are being used, or that linemen are taking out a supply of copper wire and not accounting for the unused portion.

In approving vouchers, the attached invoices may suggest extravagant methods of purchasing, either through buying at exorbitant prices, or in quantities too large or too small. The assistant treasurer should realize, possibly more than any official, that his approval is not a mere formality; neither should prior approvals relieve him of his sense of responsibility. His signature in his official capacity means dollars to the company, even though checks and vouchers require a countersignature.

The right assistant treasurer can, without assuming a disagreeable manner, question the merit of any bill which may have been approved for payment by the general manager.

A study of the cash book and careful estimate of the receipts and expenditures may indicate that there will not be enough money on hand two or three months hence to meet bond interest, a dividend or a note if the company's resources are not carefully handled. Vouchers should be paid, not with the simple idea of getting them out of the way, but with the philosophy of taking the full length of credit due the company. After considering those involving a cash discount, those ranging from \$10 to \$50 each can be disposed of. The comparative few that are left can be given more mature consideration.

The assistant treasurer can also make himself more valuable

to the general manager by closely following the monthly results of operation. To do this it is essential that he should make the postings to the general ledger. He should also prepare the first copy of the monthly financial report. This monthly report should show, among other things, the following:

Earnings and expenses, monthly and cumulative, current year and previous year, segregated according to standard classification.

Balance sheet, current month and previous month.

Condensed statement of cash receipts and disbursements.

Detail of suspense and accrual accounts.

Brief remarks relating to abnormal increases and decreases in earning and expenses.

Detail, by requisition number, of charges to property account. (No charges may be made to property account unless supported by an approved requisition, authorizing the expenditure.)

The finished preliminary report furnishes food for thought for both the assistant treasurer and the general manager, and after the general manager has listened to the assistant treasurer's intelligent explanations of increases and decreases in the various accounts, he is encouraged to talk about the interesting events which have occurred in the operating department for the month.

The conference ends with the two officials made mentally stronger and of greater value to the company, through this mutual exchange of knowledge.

Before leaving the subject of financial report it might be well to state that with the information suggested above, the financial report has all the elements of a trial balance, and the assistant treasurer can determine from the figures which he has entered upon it whether or not his general ledger is in balance. The accounts in the general ledger, incidentally, should be opened up practically in the same order as they appear in the financial report.

It seems more logical, in treating with the other members of the force, to recognize the work from its inception to its completion, and with that idea in mind we will take up, first, the

LINE ORDER AND BILLING CLERK, LIGHT AND POWER DEPARTMENTS.

The principal duties of this clerk are as follows:

Daily recording, on customers' cards, of "cut-in" and "cut-out" advices received from the contract department.

The advices should be progressively numbered in two series,

one for "cut-ins" and the other for "cut-outs," in order that missing advices may be readily located.

The customers' cards should be of different colors to represent the various classes of service, such as power, light, fans, etc., and so ruled as to provide for the following information: Customer's name and address; ledger reference number; type of meter, with adequate space for dates of, say, six possible changes of meters. The remaining space is allotted to cumulative monthly readings, net readings, rate and gross amount of bill for a period of 12 months. The back of the card may be printed in a similar manner, thus giving a life of two years.

This clerk also enters, on these same cards, meter readings received from the meter readers and the consequent computations representing the charge against the customer.

It may be well to state that another set of cards is on file in the contract department, giving such information as connected load, class of business, date of "cut-in," life of contract, etc.

The balance of the line-order clerk's time, under normal conditions, is devoted to the making of customers' bills.

METER READERS.

The title is self-explanatory, and with the daily reading system, two men would be fully occupied with 4000 customers.

We are experimenting in one of our gas companies with a patent system for the reading of meters, arranged by the Albree Self-Figuring System Company, of Boston, Mass., whose business it is to eliminate detail figuring and re-copying of figures in mills, factories, etc., obtaining immediate results by the punching of patented cards, etc.

The system, as arranged, consists of a meter card which records the various readings of the meter in connection with a folded bill made up of three parts: the bill proper, the cashier's coupon and the auditor's coupon. The bill and the meter card are addressed by machine. The meter card is placed in a certain position on the bill and a hole punched on a number corresponding to the reading of the meter. The punch is provided with a small battery lamp. The auditor's coupon is then detached and returned, with the meter card, to the office for record and information, where it is possible to arrange it into a card-ledger system.

The charge for electricity or gas used, and also the charge less the cash discount, and the number of kilowatts or number of

feet consumed having been automatically figured and recorded on the bill, it is handed to the consumer.

One man has read in one day 200 gas meters, and, in addition, collected 25 per cent of these bills.

By this system the bill reaches the consumer at the time of the meter reading; it saves all copying of readings; it figures the amounts and saves all expense in the delivery of bill to consumer.

This is simply an outline. The Albree Company would undoubtedly be pleased to answer letters from interested parties asking for full details.

CUSTOMERS' LEDGER CLERK.

The 4000 customers are taken care of in two bound ledgers, with sufficient capacity to take care of development during the life of, say, 18 months. Each page is ruled for 30 customers, and so interleaved as to cover a period of 18 months. Columns are provided for power, light, cash payments, rebates, etc.

The ledger clerk makes the original entry from the customer's bill, which has been figured twice. The entry is then checked against the entry made by the line-order clerk on the customer's card.

This clerk is also responsible for keeping the customers' ledgers in balance with the balance account in the general ledger. For this purpose a recapitulation book, made from spare leaves provided for at the time of ordering the ledgers, is used for taking off ledger page totals each month to obviate the necessity of cumulative totals in the ledgers.

The rest of the ledger clerk's time is spent each month in preparing a delinquent list and in studying the condition of all unpaid accounts.

It is a good plan to arrange for opening up new ledgers at some time other than the close of the fiscal or calendar year, in order that the task of transferring may not come with a congestion of other work. Of course, by the use of loose-leaf ledgers the work of transferring is materially reduced. There are many advantages in connection with loose-leaf ledgers, and some disadvantages. For the purpose of this article, however, the bound book was selected.

CASHIER, LIGHTING DEPARTMENT.

Having selected for this important position a person with the necessary qualifications, such as integrity, courtesy, etc., it is well to have him fully understand that the company is charging for

something which it has really delivered to the customer. From some points of view current is so intangible that an inexperienced cashier is ready to agree with a customer when he tells him the bill is not right, as the method of preparing it is as much of a myth to him as it is to the customer. If the cashier can only understand that current equals plant investment plus salaries, labor and material, he is better equipped to handle the average minor complaints which are brought to him. The more serious cases should be referred to the contract department for adjustment.

For this reason it is wise to have the cashier's cage near the contract department and away from the rest of the office force, and on the street floor, if possible.

The cashier records his collections in a subsidiary cash book, properly ruled to show cash received and discounts allowed, the daily totals being transferred to the general cash book. Rebates and discounts other than for prompt payment should be recorded in a separate book, the reasons for the allowance being entered against each item. The journal entry at the close of the month can be more intelligently approved if it is supported by such a record.

The cashier should have some spare time, which can be devoted to odd jobs, such as figuring payrolls, invoices, etc.

COLLECTORS.

Light Department.—The assistant treasurer, with the aid of his delinquent list, can map out each day the more important calls to be made by the collectors the following day. The collectors should be required to make a notation against each item on these lists furnished them by the assistant treasurer, concerning the attitude of the delinquents in the event of non-collection.

The collector will be given to understand that he must use his own good judgment in his daily work; that is, if he feels that he can collect an account not on the list he should understand that he has the authority to do it, providing it does not conflict with the work of another employee.

Meter Department.—The employees of this department were not included in this organization as they report to the operating department. There is a close relation to the accounting department, however, due to the fact that the meter department keeps the meter history cards which describe the style, size, constant, company number, date of last test and location of every meter owned by the company. These cards should be accessible at all times to

the assistant treasurer, in order that he may compare with his own records, to verify constants, etc., and to see that meter tests are made with reasonable frequency, especially in connection with large power customers. In line with this check there should also be considered the advisability of a yearly check of the company's connected load, the result to be compared with the customers' cards, that reasonable assurance may be had that all parties connected to the company's lines are being charged for the current used.

CASHIER, RAILWAY DEPARTMENT.

This man is stationed at the car barn and acts in the dual capacity of cashier and night barn foreman.

The conductors turn in their cash collections to this man, together with a deposit slip. The money is counted and checked against the deposit slip, in the conductor's presence.

During the quieter hours of the night the cashier prepares a statement of his receipts and also gets the cash into shape for bank deposit. Everything is enclosed in a locked box and taken to the assistant treasurer each morning, together with another locked box containing trip sheets and transfers. The cashier does not have access to the trip sheets.

TRIP-SHEET CLERK.

The first work of this clerk each day consists of a superficial examination of the trip sheets and the preparation of a statement showing the cash collections. This statement is referred to the assistant treasurer, who compares it with the statement turned in by the railway cashier. The differences are pointed out to the trip-sheet clerk, who adjusts, through the medium of an over and short fund. These adjustments are the basis of the first entries on the daily over and short report.

The railway cash is now ready for deposit, together with the light department collections for the previous day. The daily deposit, as reflected by the bank passbook, should be in agreement with the total collections as shown by the general cash book. To accomplish this the assistant treasurer should have a petty cash fund of from \$200 to \$500 for the payment of trivial charges against the company. Invoices in excess of \$2 or \$3 should be paid by check.

After the bank deposit has been made, the trip-sheet clerk makes a complete audit of the trip sheets, recording differences on

the over and short report and notifying all conductors affected concerning their errors. Daily adjustments by conductors should be insisted upon.

This clerk spends the balance of the day in preparing the analysis of railway earnings and the condensed daily report of earnings in comparison with the same day of the previous year. He also tabulates car mileage statistics, etc.

TICKET AND TRANSFER CLERK.

The work of counting and checking transfers is all done by one girl, except at times when a complete check of transfers is made.

REGISTER READER.

This man is located at the barn and prepares the daily list of register readings, and counts and lists the number of envelopes containing transfers deposited each half trip by the conductors in the car boxes. He also does some work for the operating department.

The revenue branch of this organization seems fairly busy, and we therefore, can give attention to the disbursing and general branch.

STOREKEEPER AND ASSISTANT.

In an organization diagram covering the whole company there would be lines from the accounting department to the purchasing agent and storekeeper, but the accounting department does not have jurisdiction over the purchasing department, and sometimes no authority over the storekeeper. The advantages of giving the accounting department authority over the storekeeper outweigh the objections. The storekeeper, by one interpretation, is a cashier who receives and issues converted dollars, and the assistant treasurer cannot be said to hold a good receipt for the expenditure until he gets a supply issue receipt, properly signed, stating that the material has been used in operation or construction.

So much difficulty has been experienced in attempting to keep a proper record of supplies on hand that some officials have concluded that it is absolutely necessary to install an elaborate system of accounting. Really the chief aim is to have a systematic and conscientious man in charge of the supplies, to whom the necessity of having a well-arranged storeroom will appeal. A storeroom equipped with shelves and bins for the reception of the several classes of supplies is one requirement, and it should be the duty of the storekeeper to certify all invoices for material

received by him. The invoices should be stamped "Charge Stock, Approval No.....08." The invoices are then returned to the accounting department, and after the necessary approvals have been secured, are passed through the *voucher register* to the debit of supplies.

At the close of the month the storekeeper should forward a statement to the assistant treasurer, giving the approval numbers, names and amounts of all bills assumed by him, in order that the same may be checked, to determine whether or not all bills have been received which have been thus approved. He will then be given credit for the amounts of the numerous requisitions which he has honored from day to day, based on the invoice prices as shown by his price-list and the difference between the aggregate amount of the invoices and the requisitions should approximately represent the value of supplies on hand.

In order that there may be no great disparity between the book value and the actual value of material on hand, periodical inventories, superintended by the assistant treasurer, should be made.

If it does not seem wise to refer the invoices to the storekeeper, a special blank could be substituted for his use and the pricing done in the accounting department.

It is rare to find a man capable of issuing supplies in a thoroughly intelligent manner and at the same time competent to keep a complicated system of stock accounts. If a storekeeper is capable and anxious to adopt an accounting system it might be advisable to allow him to do it, but under ordinary circumstances the accounting system, such as cards, should be limited to a few classes of material.

VOUCHER AND PAYROLL CLERK.

This man makes up and classifies all the vouchers from information appearing on the invoices. (The company would average about 150 vouchers each month.)

He also prepares and later classifies the payrolls for all employees, excepting the general-office payroll, and devotes the balance of his time to classifying stock issue and return slips which are turned in by the storekeeper.

STENOGRAPHER.

Letter writing, filing correspondence, statement work and balance of time on clerical work.

OFFICE BOY.

Setting up names and addresses on addressing machine for customers' bills, running errands and other duties of this general nature.

CHIEF CLERK.

The chief clerk is mentioned practically last, as the work of all subordinates is referred to him, and having been passed upon by him is, in turn, submitted to the assistant treasurer for final disposition.

This man should, of course, have a complete knowledge of the detail work of the office and spend a good deal of his time in keeping in touch with the work of every man in the department, lending a hand where necessary and seeing that each day takes care of its fair share of the month's work, rather than postponing such things as classification of stock slips until the last of the month, when time is sorely needed in closing the accounts for the month.

The chief clerk should keep the general cash book, voucher register, miscellaneous accounts receivable ledger, subsidiary construction ledger, and all miscellaneous journal entries.

In connection with journal entries, it might be said that a good deal of work can be saved and uniformity secured, by the preparing of a blanket journal entry covering all the stereotyped entries for the month, such as gross earnings, bond interest, taxes, etc. The draft of this entry could be made by the stenographer, who would make four or more copies at one operation, thus furnishing material for as many months. Journal entries prepared on the typewriter usually contain more information than those written in longhand.

The chief clerk should be a man with a sufficient ambition, and should be given the opportunity to fit himself for the position of assistant treasurer.

This seems to be a fairly complete summary of the principal work to be cared for by an accounting department of a combined railway and light company.

It is, of course, understood that practically all of the men mentioned should be bonded and their work subject to a periodical examination by an outside auditor.

THE STREET RAILWAY CONVENTION

By L. H. PARKER.

The twenty-seventh annual convention of the American Street and Interurban Railway Association and its four affiliated associations was held at Atlantic City, N. J., from October 12th to 16th inclusive. The weather, like last year, when the convention was also held at Atlantic City, was ideal throughout the entire week, which was taken full advantage of and greatly appreciated by the golfers, sailing parties, automobilists, and other lovers of outdoor sports and recreations.

The attendance was large it being computed that there were about 4000 railway operating and supply men in attendance—about 1800 operating men and 2200 supply men.

The papers and committee reports read before the convention were especially good, as were the discussions of the same. Among the papers was one by Mr. A. R. Patterson, of the auditing department of the Stone & Webster Management Association, on "Organization of the Accounting Department of an Electric Railway and Light Company." The exhibits of electrical railway apparatus were, without any doubt, the most elaborate and instructive ever presented. The Young's Million Dollar Pier, where the exhibit was located and where most of the meetings of the different associations were held, is finely appointed for just such occasions.

The annual Supply Men's Vaudeville Performance was especially good this year, and there were several other amusements in the theatrical line which were well patronized. The informal hops and receptions at the various hotel parlors were well attended and very much enjoyed by all in attendance.

President Goodrich made a suggestion in his remarks to the American Street & Interurban Railway Association that separate times and places for conventions of the main and affiliated associations be arranged for. Mr. Goodrich's suggestion was most conservatively considered in the meetings, and a resolution was adopted at the final meeting to have the incoming president, Senator James

F. Shaw of Massachusetts, appoint a committee which shall report next year to the convention as to what action should be taken in its judgment in regard to the matter.

The Stone & Webster organizations had a large number of representatives present at the convention. They were as follows:

Earl C. Hart	Tampa
Edward E. Potter	Seattle
Frank Dabney	Seattle
H. H. Hunt	Boston
William I. Sturtevant	Everett
Louis H. Bean	Bellingham
A. D. Campbell	Seattle
C. O. Birney	St. Louis
Henry B. Sawyer	Boston
Alfred R. Patterson	Boston
Lee H. Parker	Boston
John W. Leadley	Pensacola
H. H. Harrison	Jacksonville
Thomas C. Folsom	Tampa
John S. Bleecker	Columbus
F. N. Bushnell	Boston
George W. Rounds	Savannah
Mark Lowd	Dallas
H. F. Grant	Boston
H. S. Potter	El Paso
George C. England	Boston
H. L. Harding	Houston
F. R. Coates	Boston
Lyman Delano	Boston
Alfred F. Townsend	Sydney, Cape Breton
Arthur K. McCarthy	Sydney, Cape Breton
Alba H. Warren	Pensacola
H. C. Beck	Houston

News from the Companies

BOSTON OFFICE.

Mr. Edwin Sibley Webster has been nominated for the presidency of the Alumni Association of the Massachusetts Institute of Technology for the coming year.

The following are the changes which have taken place in the personnel of the statistics department in the last month:

Mr. Berryman T. Longino has gone to Seattle, where he is now working in the Georgetown shops of that Company.

Mr. Philip S. Sweetser has become assistant to Mr. W. H. Blood, Jr., taking the place made vacant by the transfer of Mr. Herbert Nash, Jr.

Mr. Earle L. Milliken, University of Maine, '08, who recently entered the department is now familiarizing himself with lighting work with the Lowell Company.

Mr. S. B. Tuell is making an extended visit to Ponce to assist in the preparation of new bids for municipal lighting.

The following men who have recently entered the statistics department are still in the Boston office:—

Alfred G. Place, M. I. T., '08.

Shirley R. Crosse, L. S. S., '06.

Dwight E. Lowell, University of Michigan, '05.

Philip I. Robinson, University of Maine, '08.

Thomas G. Webber, M. I. T., '06.

The appearance of the statistics department has been entirely changed by the removal of the partitions between the rooms which it occupied.

Mr. and Mrs. M. M. Phinney on October 2 returned to Dallas, Tex., after spending the summer in Boston.

Mr. George J. Baldwin, president of the southeastern companies, was in Boston three or four days on his way home from his vacation in the mountains of Colorado.

Mr. David Moore, contract agent of the Savannah company, was in Boston the latter part of September.

Mr. Leonard, manager at Minneapolis, spent a week in Boston recently, the first of October, or—at any rate it was during the Brockton Fair. He was here on business.

Mark Lowd, manager of the southwestern office of the Stone & Webster Engineering Corporation, arrived on a visit to Boston early in October.

Among the recent visitors of the executive department of the Engineering Corporation was Judge Brady, governor of Alaska, who is interested in irrigation developments.

The annual convention of the American Street & Interurban Railway Association, Oct. 12th to 16th, at Atlantic City, was attended by the following members of the Engineering Corporation,—F. R. Coates, G. C. England, Lee H. Parker, F. N. Bushnell and Mark Lowd.

Geo. C. England, assistant treasurer of the Engineering Corporation, recently returned from a trip which included Helena and the Puget Sound District.

The first of the series of monographs descriptive of the experience and facilities of the Engineering Corporation has been issued. The printing, illustrating and subject matter are very carefully worked out and the effect is distinctive.

The plan of the Engineering Corporation for extending its acquaintance among financial and business interests has been made more comprehensive by sending to the managers of the Stone & Webster companies, who are likely to learn at an early stage of new developments in their respective districts, reference cards on which the names of men who should be reached are returned to the Corporation. These names are immediately placed on the executive department lists, and will receive thereafter all matter distributed by the organization which treats of the experience and facilities for engineering and construction.

A. W. Hunking, a member of the construction staff at Hauser Lake, is on a trip to Boston in relation to that work.

During October the offices of the Stone & Webster organization in Boston were visited by the following representatives of the different companies under Stone & Webster management: Earl C. Hart, Tampa, Fla.; Edward E. Potter, Seattle, Wash.; Frank Dabney, Seattle, Wash.; William I. Sturtevant, Everett, Wash.; Louis H. Bean, Bellingham, Wash.; A. D. Campbell, Seattle, Wash.; John S. Bleecker, Columbus, Ga.; George W. Rounds, Savannah, Ga.; Mark Lowd, Dallas, Tex.; H. S. Potter, El Paso, Tex.; H. L. Harding,

Houston, Tex.; Alfred F. Townsend, Sydney, Cape Breton; Alba H. Warren, Pensacola, Fla.; H. C. Beck, Houston, Tex.

Mr. Ernest Ross Adams of the auditing department is to be married on November 3 to Miss Addie Borden of Fall River.

On October 24, Mr. Edgar Bailey Cooper, superintendent of lighting, Ponce Railway & Light Company, was married to Miss Buena Buckley Ullyette Hoyer.

The securities department reports that the first mortgage bonds of Tampa Electric Company, due June 1st, 1933, which originally were offered jointly by Messrs. Redmond & Company and Messrs. Stone & Webster, at 93¼ and interest, have advanced in price with the improvement of the company's earnings. They are now selling at 95 and interest and the supply is very limited.

The capital stock of the Pacific Coast Power Company, also, has been in good demand at advancing prices, the last sale being at 68, at which price the return on the investment is 5.90 per cent.

Mr. Herbert H. Holton, of the securities department, made a short visit to the Chicago office during the early part of October.

A quarterly dividend of \$3 per share on the capital stock of Fall River Gas Works Company has been declared payable November 2nd, 1908, to stockholders of record at the close of business, October 19th, 1908. Dividends of this company hereafter will be payable quarterly, and the amount of each payment will be \$3, if such amount seems advisable, making the dividend rate 12 per cent instead of 10 per cent, as formerly.

The present price for gas in Fall River is ninety cents per 1000 cubic feet, and the rate will be reduced to eighty-five cents per 1000 cubic feet on November 1, 1908.

CANTON, MASS.

Mr. Roy Faulkner, chief clerk of Tampa Electric Company, has made the Blue Hill Street Railway Company a call since the last issue.

Mr. Worthington Cornell, of the statistical department, made us a flying visit.

Master mechanic C. G. Cleveland, who has been on the sick list for a few days, is again in charge of the car barn.

The aluminum cell-type lightning arresters that were installed in our power station did not work properly, and the General Electric Company ordered them sent to Schenectady; they are going to install another set in their stead.

(F. T. Buchanan.)

BROCKTON, MASS.

The annual Brockton Fair came to a close on October 2nd, with a total attendance for the four days of 140,000, not quite up to the record. The Fair, however, was very successful in every way.

Among the visitors at the Fair were Mr. and Mrs. A. Stuart Pratt, Mr. F. S. Pratt, Mr. and Mrs. F. J. Hovey, Mr. and Mrs. N. T. Wilcox, Mr. and Mrs. R. W. Childs and Mr. A. W. Leonard.

Mr. H. C. Smith, cashier, has returned from a vacation spent in New York city.

Mr. F. J. Hovey of the Boston office was a visitor at this office recently.

Miss Addie J. Scribner, assistant cashier, is spending a ten days' vacation in New York, Philadelphia and Atlantic City.

Contracts have been closed with the Hide-ite Leather Co. for an installation of 287 H. P. in motors at their new factory.

Orders have been received from the city for three additional street arcs and forty-seven additional street incandescent lamps.

LOWELL, MASS.

The Stone & Webster Engineering Corporation are pushing forward the work of installing Taylor stokers under our Stirling boilers with all possible speed. The stokers are on the ground, and work has been undertaken on No. 2 boiler. The forced draught air duct is being installed, and the installation will be completed in time to take care of our heavy load coming this fall.

An interesting feature connected with the operation of our company is the installation of telephones at several different points throughout our transmission system. These 'phones are installed and maintained by the telephone company and are for the use of our employees only, the object being that our troublemen, inspectors and linemen at any time during the twenty-four hours when at work on our transmission system at any point shall find themselves near a telephone, through which they can reach our main office and advise regarding opening circuits or give information concerning the work. This has been a source of saving, in that our night inspector has made it a practice to call the office from each telephone when in the respective districts. By so doing, he is advised of any trouble which may have been reported on the line; thus, going directly to the point of trouble rather than coming into headquarters for directions.

(J. A. Hunnewell.)

PLYMOUTH, MASS.

The question of a new town hall for Plymouth was reported on by a committee appointed for that purpose, and they recommended a site on the new Main Street extension, where the building and land together would cost approximately \$125,000. A special town meeting was called on October 3rd and this proposition was voted down, so that the question of a new town hall is still as far off as ever.

Recently a contract was signed between the town, State and Plymouth Cordage Co. on the one side and the Eastern Dredging Company on the other for dredging the channel from the main channel to the wharf of the Plymouth Cordage Co. An appropriation of \$160,000 was made jointly by the State, town and Cordage Co. to pay for this improvement, but they were fortunate in being able to make a contract for this work at approximately \$127,000. The result will be a channel from 150 ft. to 250 ft. wide and from 18 ft. to 20 ft. at mean low water. This will allow freight steamers to come in at almost any height of tide, and will add greatly to the imports into this town.

It is estimated by the Plymouth Cordage Co. that imports of raw materials will amount to over \$7,000,000 per year from this new improvement. The dredging of this channel brings up the necessity of a break-water at the entrance to the harbor, and through various channels this has been brought to the attention of the national government, so that a public hearing was held on Friday, October 17th, at Town House, Plymouth, before a board of engineers from the war department. Many of the leading industries of Plymouth were represented at this hearing and much valuable information was presented to show the needs for building this breakwater, and in due time it is hoped that the government will make an appropriation to build a suitable breakwater from the end of Long Beach to the eastward on Brown's island.

The question of a site for a new post office has caused a good deal of agitation as to the best location, and the problem is now to find a suitable site that will come within the amount of the appropriation—viz., \$22,000, with a balance of \$65,000 for the building. It is now planned to try and have the law changed so that more of this money can be set aside for the land, in order that a more suitable location can be obtained. With all these various improvements, Plymouth should make considerable strides in growth during the next few years.

(Howard F. Eaton.)

WOONSOCKET, R. I.

The boards of directors of the Woonsocket Electric Machine & Power company and the Woonsocket Gas Company have decided to consolidate the business offices, and to some extent the administration, of the two companies. The Gas and Electric Companies will continue to operate as separate organizations, except in such departments where economy will be derived by merging the two departments.

Mr. Frank E. Holden, president of the Woonsocket Gas Company, while retaining his position as president, will retire from active management. Mr. Thomas Nickerson, present manager of this company, will be manager of the combined organization.

We firmly believe that by this arrangement, and by reason of the advantages of having an office on the main street, we shall be better able to serve our customers in every way.

Since the last news from this company, we have lost, by resignation, two members from our organization, Mr. E. M. Ellery our assistant treasurer, having decided to go into business with his uncle in Taunton, and Mr. F. S. Pond, former superintendent, after twenty-five years faithful performance of his duties with this company, having decided to retire from active service. Mr. Pond has made no arrangements as yet for the future, but is taking a vacation and getting a much needed rest.

The retirement of these two officials will be regretted by many in this city, as both were well known and had numerous acquaintances.

The place of the assistant treasurer will be filled by Mr. C. H. Byrne, formerly of Tampa. Mr. Byrne has had considerable experience in Stone & Webster companies.

The duties of Mr. Pond are taken care of by enlarging those of Mr. P. F. Hodgkins, superintendent of distribution, and Mr. David A. Chapman, chief engineer. The real estate, which formerly was in charge of Mr. Pond, it was deemed advisable to place in the hands of a competent real estate agent in this city, Mr. John C. Cosseboom, thus relieving the company from the duties incidental to the management of real estate property.

Work on the numerous construction jobs of the company is progressing rapidly. The Engineering Corporation are nearing the end of the Franklin transmission line, which they expect to have in operation anywhere from the 15th of next month to the 1st of December. The completion of this transmission line is of

considerable interest to the company, as we are more than anxious to supply Franklin with a twenty-four hour service as soon as possible. We feel sure that this service in Franklin will be productive of very favorable results.

The erection of a 150 ft. steel stack was completed without accident, and the stack is at present doing good service on three 284 horse power boilers. At times of our heaviest load, Wednesday and Saturday nights, we are forced to operate, due to low water, seven boilers, whereas previously we could carry our load on the five boilers which are connected to our other chimney. The steel stack was erected in time to be of the most service to this company.

Of late the company has acquired the riparian rights to an additional one-sixteenth part of the flow of the Blackstone River, thus making its privilege at this point equal to four parts in sixteen of the total water flow.

Our total privilege is made up of two parts, four-sixteenths being on one side, and seven-sixteenths, at a different head, farther down on the other side of the river. We have been giving much attention to our water power developments of late, both to repairing our present equipment and to figuring on future developments in this line.

By the completion of a coal pocket close to the boiler room, we are now in a position to store almost two thousand tons of coal. With this quantity on hand, we shall be in shape to take care of any delay in our monthly contract delivery of coal, or any tie-up on the railway, for a period not exceeding three months.

The company expects within a short time to have reconstructed its distributing system to such an extent as to enable it to take advantage of the 60 cycle power, which it has purchased under contract from the Hamlet Textile Company's mill.

COLUMBUS, GA.

It is gratifying to note that the cotton and spinning mills have been working full time during the past few months and report a good volume of business ahead. The Topsy and Perkins Hosiery Mills report an abundance of orders, which have made it necessary for them to work night and day in order to meet the demand.

The coping on the City Mills' dam has been completed during the month, and the gap left in the dam when high water overtook the contractors last fall is now being closed up. This is a new masonry dam at which our No. 3 power house is located, and has

been in process of construction some three or four years. The dam is owned by the City Mills Milling Co., from which we lease power.

During the early part of October we suffered from low water, which made it necessary to operate our auxiliary steam plant. This condition, however, did not last more than a week, when we obtained an abundance of rain, which has given an ample volume of water. We hope the drought that has prevailed for the past month has been broken. The weather has been unusually cool for this season of the year and is now very fine and sunshiny.

Manager Bleecker has been away since the early part of October on business in Boston, and at the time of writing is attending the Convention of the American Street & Interurban Railway Association at Atlantic City, after which he will take a short pleasure trip before returning to his desk at Columbus. Mrs. Bleecker and son are visiting Mrs. Bleecker's parents in Nashville during Mr. Bleecker's absence.

General Superintendent Young has recently moved into a new bungalow on Rose Hill. The house is located on that portion of Rose Hill known as Waverly Terrace. This part of the city is becoming very popular as a residence section and many new houses have been erected there during the past year.

Mr. H. M. Corse has taken up duties in connection with the power stations. At present, he is acting as operator at the auxiliary steam plant.

One of the most important annual events in Columbus is moving day, which takes place on the first of October. On that day it seems as if everybody were moving from his old residence to a new one. The streets are filled with vans conveying furniture from house to house, which in many instances has to be left on the lawn over night. It can readily be imagined that the forces of the gas and electric lighting departments are rushed with an almost overwhelming number of "cut ins" and "cut outs" and service and gas range changes.

Mr. Henry O. Burnside of our meter department, was married on September 17th to Miss Lucy E. Smith, of Columbus. They are residing at the home of Mr. Burnside's mother in Phenix City.

PENSACOLA, FLA.

Work has commenced on the city lighting contract of installing two hundred 40 c. p., 6.6 ampere, 50 watt series Tungsten

lamps, which are to be distributed on the North and East Hill, in the residence sections of the city.

This installation will require 500 poles and 20 miles of wire, to be divided into two circuits.

The circuits will also approach each other in a number of places, enabling tests to be made for open circuits, at the same time affording an opportunity to "jump out" an open circuit, thereby eliminating any possibility of reducing the entire system to darkness even for one night.

To handle this contract, a 22 Kw. "tub" transformer and a two-circuit panel switch board will be installed. As 6.6 ampere lamps are to be used, the system will be interchangeable with the present arc lighting system.

This work has been laid out and will be installed by our local force under the direct supervision of Mr. E. G. Howard, superintendent of lighting.

Realizing that the five year contract would expire on January 1st, 1908, the contract department took steps a year ago last July to encourage the city, through its board of public works to install series Tungstens, which replace the Welsbach lights heretofore used.

The new contract, as signed in September, covers a period of five years, and calls for the continuance of the present arcs, and in addition two hundred Tungstens, burning on all night schedule.

Mr. E. J. Seaborn, our cashier, was married October 14th to Miss Helen May Britton of Philadelphia. Mr. Seaborn came to this company in June, 1907, from Boston, where he had been previously employed in the accounting department.

Messrs. Howard, Roberts, Richardson and Carroll have recently visited New Orleans. They are unanimous in their opinion that the Crescent City is well worth a visit.

Manager Alba H. Warren left on the 13th for a visit to his home, Worcester, Massachusetts. He will also answer roll call at the Atlantic City Convention, and pay his respects to the Boston Office.

TAMPA, FLA.

The Tampa Water Works Company applied to the State and received permission to amend its charter so as to increase the limit of indebtedness of the company to \$1,000,000. This is to provide for the new mains required at different sections of the city, especially in the districts recently annexed, which have no city improvements.

Cigar manufacturers report their branch of trade somewhat improved, and are adding slowly to their forces. The new Calixto Lopez factory in West Tampa was opened on September 14th with a number of operatives. After the November elections it is thought that conditions will improve greatly in local cigar circles.

On October 7th the Mallory Line began a new schedule from New York, placing a third vessel, the "Alamo," on the route to Tampa. This line now touches at Key West, and after leaving Tampa continues to Mobile. The officials of the company are reported as being well pleased with the success of the line from Tampa. On several recent trips the ships had to leave some freight on the docks here that was intended for New York, and were unable to bring down what was consigned to Tampa. The new schedule gives a boat from here to Key West and New York every Monday, and a boat leaves Key West for Tampa every Sunday.

The track on Franklin Street, from Fortune Street to Seventh Avenue has been prepared for vitrified brick pavement, which, when completed, will leave Franklin Street paved with brick throughout its length, from the bay to the end of the street.

The property owners who obtained an injunction during July against the extension on Seventh Avenue beyond Thirtieth Street, have withdrawn their proceedings, and the work is now being carried on. This line operates from the eastern boundary of Ybor City to the end of the line in West Tampa, traversing the principal streets in both places.

On September 17th there was an important meeting of a committee from the board of U. S. Engineers and the local board of trade, together with prominent citizens interested, to discuss the matter of harbor improvements. The engineers listened to the different ideas advanced for improving the harbor, such as deepening the main channel from 20 ft. to 24 ft., dredging an additional channel eastward from the present Hendry and Knight docks along the shore toward Ybor City, making a loop channel from the main channel eastward around Grassy Island, touching the Tampa Northern R. R. and Seaboard terminals and coming back into the main channel so as to permit vessels to come in and go out without turning around, and also the deepening of the channel in the Hillsborough River to the Lafayette Street bridge, and will recommend to the War Department what seems to them the most feasible and urgent plan. It is generally assumed, however, that a 24 ft. channel from the city to deep water in the outer bay

is assured, and that the other ideas will receive consideration in the order of their importance from the Government's point of view.

The park theatrical season came to a close the first week in October at Ballast Point. The Mabel Paige Stock Company, which played in Tampa at the Ballast Point casino during the entire summer of 1906, will be seen there again for two nights in the latter part of October.

Mr. Mark Lowd, of the Engineering Corporation, paid us a visit during the first week in October, leaving here October 6th.

Mr. E. B. Powell, of the Engineering Corporation, has returned and is again busily engaged in the study of various matters at the West Jackson Street station.

At this writing Messrs. E. C. Hart, assistant treasurer, and T. C. Folsom, superintendent of roadway, are attending the Street Railway convention at Atlantic City, being the only representatives of the local organization at the convention. After the convention Mr. Hart will visit his old home in Fall River for a few days, returning with Mrs. Hart, who has been there for the past two months, while Mr. Folsom intends visiting Boston before his return to Tampa.

EL PASO, TEX.

The city of El Paso has sold its \$500,000 bond issue to Mason Lewis & Co. of Chicago and the cash is now on deposit in El Paso. This money will be used for extensions to the paving, schools, sewage system and grading. Bitulithic pavement seems to be the favorite. This form of pavement was used for the first paved streets in the city and has stood the heat of El Paso summers with what is considered remarkable success, so that the people feel confident of its wearing powers.

In the middle of September the Commissioners Court of El Paso county granted a franchise on the county road down the valley to W. B. Latta and others for the construction of a valley line, which extends for 28 miles down the valley to a town called Fabens. It is proposed initially to build only as far as Ysleta, a town twelve miles from El Paso. This road will approximately parallel the line of the Southern Pacific system. The valley below El Paso is very fertile and with the present condition of irrigation produces a large amount of garden truck, alfalfa and fruit, which the proposed line hopes to transport to El Paso. The franchise grants the right to charge a fare for passengers of 3 cents per mile. This is the same rate as is now charged on the Southern Pacific,

and the Santa Fe charges 4 cents a mile. The money to construct this line will be raised in the city of El Paso and by the farmers in the valley below the city. The line will be a useful feeder to the El Paso Electric Railway Company.

Mr. Kellogg, Mr. Dixon, claim agent, and Messrs. Leigh Clark and M. Nagle, our attorneys, recently attended a meeting in Houston of the managers, claim agents and attorneys of the Texas companies.

Mr. H. S. Potter, general superintendent of the company, attended the annual convention of the American Street and Inter-urban Railway Association in Atlantic City in October.

The annual Irrigation Congress, which is of international scope, was held in Albuquerque, New Mexico, in the latter part of September. At this congress some very important work was done for the welfare of El Paso. There has been for some years past a conflict between the interests of the land owners in southern Colorado and those of southern New Mexico and west Texas about the division of the waters of the Rio Grande for irrigation purposes, and it looked for a time as if the northern powers might prevail. At this congress, however, not only were the El Paso delegation successful in obtaining all the rights contemplated by the Rio Grande project described in the September number of the Public Service Journal, but they arranged to have the work on the Eagle Dam completed two or three years sooner than had originally been expected. What really saved the day was the international obligation between the United States and Mexico by which the former had agreed by treaty to deliver to the Mexican people 55,000 acre feet of water per annum, which agreement the United States would have been powerless to carry out if the people in Colorado had obtained what they wanted.

The visit of Barnum and Bailey's circus to El Paso on October 3 made the occasion for us to beat our best previous record for one day's street railway earnings, the new mark being \$1720, as against \$1625, which was the best previous performance.

The Rio Grande has been absolutely dry since September 15. This is the first time this calamity has happened for about four years. We say "calamity" not only on account of the loss to the valley farmers, but because it makes our toll bridges a superfluity to pedestrians.

(C. W. Kellogg, Jr.)

DALLAS TEX.

The city of Dallas has just secured for its electricians' depart-

ment a complete set of electrical instruments for testing purposes. Any customer, complaining to the city that his electric light bill is unreasonably high, can, upon deposit of fifty cents, have his meter tested by the city. If found correct, the deposit remains in the hands of the city to defray the expense of testing; if not correct, the deposit is refunded to the customer and the electric light company forfeits one dollar to the city, providing the meter tested is over two percent fast.

We consider this method one which will greatly benefit the lighting company, inasmuch as customers who are inclined to complain after having their meter tested by an outside party, can but feel that the lighting company is not taking advantage of them.

Mr. M. M. Phinney, district manager, arrived in Dallas on the 4th inst., after having been in the Boston office during the summer.

FORT WORTH, TEX.

The Northern Texas Traction Company has for the past five or six years occupied a building for its office and waiting room at the corner of Main and Third streets. This was a three-story brick structure built a great many years ago. Early in September, evidences of cracking walls presented themselves and a leading firm of architects was employed to make an investigation. The attention of the city authorities was also called to the condition of the building, with the result that the city condemned the structure, ordered it vacated and torn down. The company was occupying the three floors and naturally required a great deal of space, and the difficulty presented itself of finding suitable quarters until such time as the building could be rebuilt. We succeeded in getting the ground floor and basement of a building at the corner of Houston and Fourteenth streets. The room where the office is now located is fifty by one hundred feet, and all of the offices are on one floor without partitions. The basement is used for the storage of papers, etc. The company has entered into an agreement with the owner of the old building at the corner of Third and Main streets to tear it down and erect a new building. The new building will be three stories and a basement of red pressed brick. The waiting room, which will be in the front on the first floor, will be handsomely fitted up with marble trimmings and oak finish. The second floor, which will be occupied by the offices of the company, will be partitioned off and arranged to suit the convenience of the company, and the third floor will be used for the present for the storage of stationery, blue prints, etc. We shall probably continue to

occupy our present quarters at Fourteenth and Houston streets until some time in February, by which time we hope the new building will be completed.

During September, Mr. W. L. Weston, who has been purchasing agent for the company for two years, was made assistant to the general superintendent. In addition to his duties as purchasing agent, Mr. Weston will devote part of his time to collecting data for the operating department and will be of general assistance to the head of that department.

Mr. E. E. Nelson, electrical engineer of the company, has returned from a short trip to Boston.

On October 7th, 1908, representatives of the Traction Company spent the day in Houston in conference with representatives of the other Stone & Webster properties in Texas, discussing the damage suit proposition, this meeting having been called by Mr. M. M. Phinney, the district manager, who was also present. The representatives from the Traction Company were Messrs. S. B. Cantey, attorney, H. T. Edgar, manager, and W. C. Forbess, claim agent.

PADUCAH, KY.

The Ohio Valley Improvement Association Convention, which meets in Louisville on the 22nd and 23rd of this month, is engaging the attention of public spirited citizens just now. A delegation will attend from here, and it is hoped that the convention next year will be secured for Paducah.

This association was organized fifteen years ago for the purpose of securing from Congress a just recognition of the importance of improving the natural water-ways of the country, more especially the Ohio River. After repeated efforts the attention of the River and Harbor Committee was secured, and at the present time thirteen of the fifty-four locks and dams estimated as being necessary by government engineers are either completed or under construction, and enough has been accomplished to demonstrate the success of the plan.

The new double track on Broadway has been completed and the street turned over to the paving contractors. In spite of difficulties of operation, cars have been run regularly over this section, a fact that is generally appreciated by the public.

Mr. W. F. Paxton, one of our directors, has just been elected director of the Chicago, St. Louis & New Orleans Railway. This road is the principal subsidiary line of the Illinois Central system.

MINNEAPOLIS, MINN.

While en route to Seattle Mr. B. T. Longino, formerly of the statistical department of the Boston office, spent a few hours in Minneapolis about the various plants of the company.

With the dedication of the West Side High School of this city, comes an item of electrical interest. This school is fitted with a very extensive plant for manual training; electric motors are used for power drives and in illumination a highly desirable system of Tungsten lighting has been installed. In this one building over six hundred and forty watt lamps are used.

On October 8th, Manager A. W. Leonard and Engineer C. H. Harris returned from the Boston office after a business trip of two weeks. In connection with this trip it was decided to overhaul the dismantled triple expansion engine which, in October last, met with an accident, breaking a connecting rod which drove through the cylinder head and caused several minor damages. This engine is of the D. P. Allis make and is rated at 1350 H. P. New cylinders are to be installed, and the engine is to be changed to a cross compound. The repairs will consume the greater part of six weeks. When in service the engine drives the line shaft of our Main Street Station; from the line shaft the arc machine, 500 volt generators, motor generator, etc., are driven. With the service of this engine and the storage batteries, which are soon to be repaired, the annual peak of the system on about December 20th will be well taken care of.

Reverse current circuit-breakers and speed-limit devices are to be installed in the six 35 cycle rotary converters at the Fifth Street sub-station of this company.

In order to meet the rapidly increasing load on the Edison D. C. system, it has been found necessary to add two new 1,500,000 C. M. feeder cables to the underground system. Also, on the single-phase system one cable has been added, to handle the increase on the power load.

Mr. Carl Lawson of the engineering department has but recently returned from the East, where, on the last of September he was married.

(R. H. McGrath.)

HOUGHTON, MICH.

The Houghton County Traction Company has ordered from The J. G. Brill Company four new cars, which will be delivered about the middle of November. These cars are slightly longer than

those at present in use, being 42 ft. 9 in. over the bumpers, and will seat 44 people. They are to be equipped with 4 G. E. 80 motors, General Electric K-28 J control and Allis Chalmers air brakes. The only marked difference between the car body of the new cars and our old cars is that the new cars have an 18 in. x $\frac{1}{4}$ in. steel plate the whole length of the car and around to the doors, one continuous piece on each side, to give the stiffness to the body that is necessary for bucking snow in this climate. Hot-water heaters are to be used instead of electric heaters, and three out of the four are to be equipped with the snow plow nose which has been so successful in keeping our lines open the past two years.

Electric Park closed the last of September, after one of the most successful seasons in its history.

The following figures taken from the report of the Mine Inspector of the Copper Country show well the effects of good management and of the care which is taken of the miners working in this district. For the fiscal year ending September 30, 1908, the report states that 17,224 men were employed by the mines, and that during the year only 58 fatal accidents occurred, or about three-tenths of 1 per cent.

From the appearance of the Mohawk extension, there can be no question that the work will be finished and cars running by the middle of November. The grading is all completed, the trestles well under way, and about one-half the track laid, ready for ballasting. It has been decided to adopt standard design for the stations, of which there will be five. These stations will be two-story, wooden buildings, having a large waiting room on the ground floor divided into two parts, one for men and one for women; the upstairs section will have four large rooms for the care-taker and family. At Ahmeek the station will, further, have one large room in the back for the 400 Kw. motor generator set.

The following statement shows the condition of seven national banks, five state banks and one trust company, at the close of business September 23, 1908. As a rule, people who have not visited the Copper Country do not appreciate the amount of business transacted here. This statement gives an idea of this; it also shows the admirable condition of the banking interests:

CONDENSED STATEMENT.

RESOURCES.

Loans and discounts.....	\$9,552,293.83
Bonds, mortgages, etc.....	1,859,631.31

Overdrafts	24,395.51
Banking houses, etc.....	369,994.54
Due from banks and bankers.....	3,236,956.52
Cash	1,347,252.33
	<hr/>
	\$16,390,524.04

LIABILITIES.

Capital and surplus.....	\$2,330,000.00
Undivided profits, net.....	409,441.23
Circulation	451,000.00
Deposits	13,200,082.81
	<hr/>
	\$16,390,524.04

Few people outside of those directly connected with the operation of copper mines in the Lake Superior district realize the depths to which shafts have been sunk and the amount of work necessary to bring the copper bearing rock to the surface. Imagine a tunnel cut through solid rock from a mile to a mile and a half deep, and some idea may be gained of their enormous depth. These shafts, as a rule, are not vertical, but follow the dip of the lode, which ranges from about 25 degrees in the northern end of the peninsula to 75 degrees in the southern end. The deepest vertical shaft is a little over a mile deep. In order to lift from these enormous depths, hoisting engines of 1000 to 8000 horse power have been installed. For a concrete example of the duty required of these equipments, the Pewabic shaft of the Quincy mine sends to the surface daily about 1800 tons of rock from an average depth of a mile. This rock is handled in two skips of approximately six tons capacity. In order to do this work each skip, traveling at a rate of speed approaching a mile a minute, must make 150 round trips of two miles each, or a total distance of 300 miles every twenty-four hours.

(P. A. Staples.)

SEATTLE, WASH.

On August 20th, The Seattle Electric Company closed a contract with the Alaska-Yukon-Pacific Exposition Company to furnish all of the electric current that will be required for light and power purposes for the Exposition. For a period beginning as soon as preparations can be made and continuing until February 1st, 1910, the contract covers the furnishing of all apparatus and material, performing the work and furnishing the current.

There will be required for light and power purposes 2500 Kw. for the use of the Exposition Company to light its buildings, grounds and operate pumps. The concessionaires and exhibitors will require another 2500 Kw. capacity, making a total of 5000 Kw. to be furnished.

This company will establish an electrical bureau on the grounds and have charge of all of the electrical work, and will furnish service to the concessionaires and exhibitors and collect for the same. A sub-station will be built inside of the grounds and current brought to the sub-station over a high tension line at 13,000 volts, and then stepped down to 2200 volts for general distribution through the grounds.

The city lighting department submitted a much lower bid on this work. The contract was awarded to this company on account of its ability to perform and reliability of service.

On September 18th and 19th there was organized in Seattle an association of the central stations of Washington, Idaho, Montana and Oregon, to be known as the Northwest Electric Light and Power Association. The idea was conceived and carried out by Hon. Arthur Gunn, president of the Wenatchee Light and Power Company, of Wenatchee, Washington. Delegates from some fifty companies in the above four states met in Seattle at the Butler Hotel on September 18th and completed the organization Saturday forenoon.

At 2 o'clock Saturday afternoon, the members attending the convention were taken in one of The Seattle Electric Company's cars to visit the A.-Y.-P. Exposition grounds, and from there to the new Georgetown plant to inspect the steam turbines in operation. Through the courtesy of the Seattle-Tacoma Power Company and this company, a banquet was tendered the delegates at the Butler Hotel at 7 P. M., which was a very successful affair.

The association starts out under the most promising auspices, considerable enthusiasm having been shown and great interest taken in the organization. It is believed that the association will become a very strong organization and do a great deal to further the interests of the electric power and power central stations of the Northwest.

Hon. Arthur Gunn was elected president of the association for the ensuing year, with the following executive committee: E. E. Potter, of The Seattle Electric Co.; H. L. Bleeker, of the Washington Water Power Co., Spokane; O. B. Coldwell, of the

Portland Railway, Light & Power Co., Portland; D. A. Shields, of the Moscow Electric Co., Moscow, Idaho; S. A. Arrowsmith, of the Yakima Electric Co., North Yakima, Wash.; I. W. Anderson, of the Walla Walla Electric Light & Power Co., Walla Walla, Wash.; and L. B. Faulkner, of the Olympia Light & Power Co., Olympia, Wash.

On October 3rd Mr. E. E. Potter and Mr. Frank Dabney left for the Boston office, where they will spend a few days before attending the convention at Atlantic City. Mr. A. D. Campbell and wife left on October 6th, and will go straight through to Atlantic City.

Our first shipment of twenty new cars has just been received, and the cars are being assembled as fast as possible, so as to be available for operation before the rainy season sets in, at which time a number of open cars will have to be taken off the lines.

TACOMA, WASH.

The Puyallup Fair has just closed, having had the largest attendance in its history. As high as eight thousand people per day were in attendance.

We have always been handicapped in handling travel to Puyallup by the inadequacy of the old line. Next year, however, our new line will be in operation, and we shall then be able, we hope, to carry the people to their satisfaction. The Northern Pacific ran trains of fifteen coaches each hourly this year in addition to the facilities furnished by us. Our trains have been well loaded, and I am glad to say that the service was under the circumstances good, and that no accidents occurred.

(W. G. Dimmock.)

EVERETT, WASH.

The authoritative announcement that the Stone & Webster interests have taken over what was locally known as the Sander line, an electric road extending from Seattle northward to within about 15 miles of Everett, was received with general approval by the people of this city. No opposition to the completion of the project is now apparent, although a considerable element at one time looked with disfavor on the proposition of an electric line connecting the two cities, arguing that the cheap and rapid transit which would be made possible thereby would benefit Seattle at the expense of Everett.

Few if any maintain this position now, as the community has come to realize that the era of walled cities is past and that the

rapid development of the country contiguous to the proposed line will more than compensate our business interests for the trade that may be lost to the larger city. At any rate, there prevails a feeling of buoyant expectancy regarding the matter and a desire that the work of construction of the intervening gap be expedited. In this connection it may be stated that there is manifest a decidedly friendly spirit toward the management. Friction with the public seems to have been reduced to a minimum.

The Tungsten lamp is rapidly supplanting the Nernst and other forms of illuminating units in this city. To the customer the superiority of the Tungstens is so apparent that they advertise themselves. The effect on the central station's load and earning capacity is so marked that the probable general adoption of this lamp is exciting careful consideration by the management. Prior to the advent of the Tungsten the Nernst lamp was by far the most popular form of illuminating unit for business houses. Second hand Nernst can now be purchased very cheaply.

Business conditions are slowly improving.

Manager W. I. Sturdevant left early in the month to attend the American Street & Interurban Railway Association at Atlantic City. He expected to return about the first of November.

(Louis Lesh.)

BELLINGHAM, WASH.

Mr. Bean left Bellingham October 4th to attend the American Street Railway Association convention at Atlantic City. He will probably be East about a month.

At the instigation of Hon. Arthur Gunn, of Wenatchee, Washington, the first meeting of the Northwest Electric Light & Power Association was held in Seattle, September 18 and 19, with the Seattle Electric and the Seattle-Tacoma Power Companies as hosts.

The Association adopted by-laws and constitution similar to those of the National Association, changes being made only as local conditions demanded. Nearly every private company engaged in the business of furnishing electric light and power to the public in the states of Washington, Idaho, Oregon and the territory of Alaska was represented.

The purpose of the organization is best expressed by the words of Mr. Gunn: "The formation of the new Association is on broad lines, allowing membership to electric light and power companies in Oregon, Idaho, Washington and Alaska, their officers and employees and the officers and employees of the supply houses, as well

as recognized engineers and technical publications. The first and most intimate benefit to be derived will be the dissemination among the members, and especially to the advantage of smaller concerns, of technical and legal information regarding light and power plants. "In a larger way the Association will draw its members into a compact body to promote more efficient, economical and satisfactory service to the public."

Saturday afternoon the delegates were taken in a special car to visit the grounds of the Alaska-Yukon-Pacific Fair, which takes place next summer. The Seattle Electric Company is preparing to furnish about 4000 Kw. in building and decorative lighting. From the Fair Grounds the special went to Georgetown, where the visitors were shown in detail a plant that is, from the oil heated boilers to the condensers of the 3000 and 8000 Kw. Curtis turbines, the culmination of all that is good in modern steam and electric practice.

Saturday evening the hungry sight-seers were seen to be hurrying from every direction and lining up in front of the closed doors of the banquet room of the Hotel Butler. At seven o'clock the doors were thrown open and the orchestra commenced a funeral waltz or Priest gallop or something of that sort, to which the hungry bread line was unable to move slowly enough. The exhibition of beauty that surrounded one on every side upon entering the room left an impression never to be forgotten. Electric fountains, slowly turning one highly colored scintillating surface and then another to the astonished gaze of the onlookers, numberless tiny incandescents of every color of the rainbow peeping out from behind tall and stately, short and fat, thick and thin iridescent glasses, all seemed to tell in color tones as plain as any words of the good taste of the hosts and their desire to bid us welcome.

After a long dinner of "Teaser Transformers," "Tub Transformers," "Submarine Lamps," "Laminations," "Armatures," "High Tension Transformers," and last but not least "Expulsion Fuses," the guests were entertained with toasts by Mr. Howe, attorney for the Seattle Electric Company, Mr. Gunn, Mr. Winter, manager of the Seattle office of the General Electric Company, Mr. Grambs, contract manager, Seattle Electric Company, and others, the speakers being induced to their best efforts by the witty remarks of Mr. Francis Rotch, toastmaster, from Fairbanks, Alaska, that happy hunting ground of the electric power man where power sells for \$1.60 per horse power per 8 hour day.

(L. R. Coffin.)

PONCE, PORTO RICO.

Ponce was threatened with a cyclone last week and all hands watched the barometer anxiously in order to determine in their own minds whether or not the event would be on schedule time. Luckily it passed south of us, so that we got no high winds, but we did receive plenty of rain, enough to raise the river some ten feet and flood the streets of the city, and a crashing surf rolled in from the ocean. This surf reached a point far above the usual high water mark and washed the door stones of several of the warehouses and stores on the beach, burying one rail of our coal track and undermining the other.

The ridge of sand along the shores of the Guancha upon which we at one time planned to build a track to connect the proposed wharf with the Playa, was thrown inland some thirty feet and so levelled off that even small waves now flow over it. We figure roughly that we have lost several acres of land by this storm. It is probable, however, that this will rapidly fill in again, as the sand is in constant motion with a general tendency to fill in along this shore.

In the city no damage was done, but so much gravel and wreckage was washed upon our tracks that the wrecking gang was busy all that afternoon keeping the line open.

Mr. Tuell has just arrived in Ponce in connection with our city lighting contract, which expires next July. We are figuring out a new system of street lighting in order to put in a bid before Oct. 15, as required by the city council. The council ask for more light and better prices.

We have recently connected up a small vulcanizing outfit for automobile repairing in the garage of Mr. Cox, who runs a line of autos between Ponce and Guayama and who also does repairing for the general public. This apparatus seems to give perfect satisfaction and Mr. Cox is talking of putting in a small rectifier for the charging of ignition batteries.

(A. S. Whitton.)

SYDNEY, CAPE BRETON.

Our railway earnings are being somewhat benefited by the present election campaign. The general Dominion elections will be held on October 26th.

We have just completed a new blacksmith and repair shop, size 40 x 28 feet. This is a much needed improvement and is being greatly appreciated by our blacksmiths and repair men. We ex-

pect to effect considerable saving on account of these improved facilities. We are also making extensive improvements at our North Sydney car barns, which will greatly facilitate operating conditions for the coming winter.

We propose equipping shortly several more of our cars with the Root snow scrapers. We find that these scrapers give good results, both in reducing snow expenses and in maintaining the regular traffic schedule.

Mr. A. F. Townsend, manager, left on the 7th instant to attend the Street Railway Convention at Atlantic City. He will spend several days at the Boston office before returning.

Mr. A. K. MacCarthy, superintendent of railway, is spending his vacation at his home in Ottawa.

(G. G. Spencer.)

COUPONS AND DIVIDENDS DUE

	Per Cent
Nov. 1, Galveston Electric Company, First Mortgage 5s, 1940	2½
Nov. 1, Jacksonville Electric Company, First Mortgage 5s, 1927	2½
Nov. 1, Paducah Traction and Light Company, Collateral Trust 5s, 1935	2½
Nov. 1, Ponce Electric Company, First Mortgage 6s, 1927	3
Nov. 1, Seattle Railway Company, The, First Mortgage 5s, 1921	2½
Nov. 1, Terre Haute Traction & Light Company, Consolidated Mortgage 5s, 1944	2½
Nov. 1, Whatcom County Railway & Light Company, First Mortgage 5s, 1935	2½
Nov. 1, Cape Breton Electric Company, Ltd., Preferred Stock, 6 per cent.....	3
Nov. 2, Edison Electric Illuminating Company of Brockton, Capital Stock	3½
Nov. 2, Fall River Gas Works Co., Capital Stock*	3
Nov. 2, Houghton County Electric Light Company, Preferred Stock, 6 per cent.....	3
Nov. 2, Houghton County Electric Light Company, Common Stock, 5 per cent.....	2½
Nov. 2, Lowell Electric Light Corporation, The, Capital Stock*	2
Nov. 16, Tampa Electric Company, Capital Stock.....	3½
Dec. 1, Brockton and Plymouth Street Railway Company, First Mortgage 4½s, 1920	2¼
Dec. 1, Edison Electric Illuminating Company of Brockton, First Mortgage 5s, 1930.....	2½
Dec. 1, Minneapolis General Electric Company, The, First Mortgage 5s, 1934	2½
Dec. 1, Puget Sound Power Company, First Mortgage 5s, 1933	2½
Dec. 16, Minneapolis General Electric Company, The, Collateral Trust Coupon Notes 6s, 1908.....	3

*Quarterly.

QUOTATIONS

ON

SECURITIES OF PUBLIC SERVICE CORPORATIONS

UNDER THE MANAGEMENT OF

OUR ORGANIZATION

OCTOBER 20, 1908

NOTE:—Quotations are approximate. Unless indicated to the contrary Bonds and Notes are 5 per cent and preferred stocks 6 per cent non-cumulative. Accrued interest should be added to quotations on Bonds and Notes.

COMPANY	BONDS	PREF.	COM
Blue Hill Street Railway Co., The	95	No pref.	....
Brockton & Plymouth St. Ry. Co.	93 ¹¹	No pref.	....
Cape Breton Electric Co., Ltd.	92½	75	15
Columbus Electric Co.	92½	....	....
Columbus Power Co., The	93 Notes 95	....	....
Dallas Electric Corporation	7, 8 85	45 ³	10
Edison Elec. Ill. Co. of Brockton	Notes 105½ 100	No pref.	160
Electric Light and Power Co. of Abington and Rockland	100	No pref.	160
El Paso Electric Co.	8 93½ Notes 96 ⁴	85	41
Fall River Gas Works Co.	No bonds	No pref.	260
Galveston Electric Co.	92½	....	....
Galveston-Houston Elec. Co.	....	85 ¹	30
Houghton County Elec. Lt. Co.	95	22½ ⁵	14 ⁶
Houghton County St. Ry. Co., The	93	No pref.	No Com.
Houghton Co. Traction Co.	92	87½ ¹	25
Houston Electric Co.	6, 7 97	....	....
Jacksonville Electric Co.	95	96 ¹	80

COMPANY	BONDS	PREF.	COM.
Key West Electric Co., The	....	....	....
Lowell Elec. Lt. Corporation, The	100	No pref.	195
Minneapolis General Elec. Co., The	98½ Notes 100	100 ^{1, 6}	85 ⁵
Northern Texas Electric Co.	100 ² Notes 100 ⁴	83 ⁷	35 ⁷
Pacific Coast Power Co.			69 ⁶
Paducah Traction & Lt. Co.	80 ⁷	45 ^{1, 3}	10
Pensacola Electric Co.	92½	75 ¹	15
Ponce Electric Co.	100 ⁴	No pref.	....
Puget Sound Electric Railway	97 ⁶ Notes, 1911 96 Notes, 1912 95	87	35
Puget Sound Power Co.	97½	No pref.	....⁹
Savannah Electric Co.	80 ^{6, 7}	45	10
Seattle Electric Co., The	105 ^{6, 7, 8} 1st m'tge Consol. and Refund m'tge convertible " " " " non-con. Notes 97 96¾	96 ^{6, 7, 8}	83 ^{6, 7, 8}
Tacoma Railway & Power Co.	98	No pref.	....¹⁰
Tampa Electric Co.	96	No pref.	106
Whatcom County Ry. & Lt. Co.	98	87½ ¹	38

1.—Cumulative. 2.—Bonds of Northern Texas Traction Co. 3.—5 per cent. 4.—6 per cent. 5.—Par \$25. 6.—Listed Boston. 7.—Listed Louisville. 8.—Listed Columbus, Ohio. 9.—Held by The Seattle Electric Co. 10.—Held by Puget Sound Elec. Ry. 11.—4½ per cent.

STONE & WEBSTER

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NOTE.—The Securities Department handles securities for those wishing to purchase or sell. Requests for information in regard to any of the above companies will be promptly answered at any time by this Department.

LIBRARY NOTES

We are to place the general order for 1909 periodicals about November 15.

Wisconsin Geological and Natural History Survey has recently published a volume on "The Water Powers of Wisconsin." Much in its general makeup leads one to wish that all the states of the Union might do likewise, adopting this publication for their standard.

Vol. III of the 1905 Census of Massachusetts deals with manufacture and trade. It contains an analysis, with comments, and the statistical tables that a census should have. In the introduction attention is called to the new feature, including "Trade" as well as "Manufactures," in accordance with the law of 1904. "The census of trade was in the nature of an experiment, being the first ever taken by any state or country." It is well to read the introduction, where the compiler states an ideal and the limitations in the attainment thereof.

The Right Hon. Lord Avebury, "On Municipal and National Trading," says in the introduction (page 21): "Our municipalities have most important duties to perform,—duties sufficient to occupy all their time and tax all their energies. They cannot both govern and trade. If they persist in embarking on commercial undertakings they will, I am persuaded, increase our rates, check the progress of scientific discovery, and stifle, if not destroy, that spirit of private enterprise to which in the past our commercial supremacy is mainly due."

The Department of Agriculture, Commerce and Immigration of South Carolina has issued thirty-three publications, beginning in 1904, the thirty-third being the second edition of the Handbook of Resources of the State. This is "a summary of the statistics of agriculture, manufactures, geography, climate, geology and physiography, minerals and mining, education, transportation, commerce, government, etc., etc." Included also are chapters on water-powers, population, and the principal cities, respectively.

Three books for the motorman have recently been added to the Library, viz.: "The Motorman and His Duties," 6th edition; "How to Become a Successful Motorman," and "How to Become a Competent Motorman." Their cost is \$1.50, \$1.20 and \$1.00, respectively. They are all good books, although the first one is rather more technical than the others.

Nelson's Encyclopedia—*Perpetual Loose-Leaf Edition*—in twelve volumes, has been added to the Library. New pages are issued from time to time for insertion in their proper places, and if the publishers fulfill their large plans this new method of publishing should prove epoch-making. They say: "If a man who has a Nelson Encyclopedia wants special information on any subject, it is his privilege and right to communicate with the editorial board, presenting the matter to them, and he may rest assured that he will have the desired information as quickly as it is possible to compile it and send it to him. This is a feature never introduced before, and we find it a very popular one."

LIBRARY OF STONE & WEBSTER

Current Literature

Selections from Recent Magazines and Book Accessions.

Ed. *, and + are used in cases of magazines to indicate editorial, illustration, and map or diagram respectively. But these symbols do not have the same significance in the case of book numbers, all of which are preceded by an asterisk.

Bridges.

- 1 Flood resisting bridge constrn in the Western U. S.: difficult conditions at Oroville, Cal in bridging the Feather River, a torrential stream. Cassler's Mag-9/08-414-4p*
- 2 Designing methods, reinforced concrete constrn, standard designs for bridges and culverts for highway traffic; flat slab & girder type. Expanded Metal & Corrugated Bar Co., St. Louis, Mo. Designing Methods, Vol I, No. 4, p111-139, 8½x5½, 1908.
- 3 Maumee cement concrete bridge for Lima & Toledo Traction Ry, Waterville, O: variation in span; method of striking centers. DVLuten. T207-116-7.5p*+
- 4 Test of a model of the Quebec bridge by Phoenix Iron Co.; methods & conclusions. RRAgeGazette-10/2/08-1045-5.2p+

. Generators, Switchboards.

- 5 Care & maintenance of storage batteries: charging; troubles & remedies; summary. FAWarfield. ELJrnl-8/08-466-7p.
- 6 Storage batteries their return & uses (concl'd): types of boosters; economies of system. PRMoses. Eng'gMag-10/08-23-9.9p*+
- 7 High tension switchboard practice in Am: types of apparatus & protective devices. SQHayes. EL'lAge-9/08-195-12P*+

Lighting.

- 8 Tungsten lp situation, symposium of views from representative central-station men; the tungsten lp in New Eng; dis at Mich conv; rept at Ohio conv on central-station experience with tungsten lps. EL'lWld-9/5/08-506-9.6p+

Gas Producers. Peat.

- 9 Bituminous producer plts: updraft producers with removal of heavy hydrocarbons; cost of gas pr. EAHarvey. ProcAmSoc Mech'lEgrs-10/08-1155-24p*+

- 10 Suction gas producer pr: developmt; gov't tests; advantages; fuels; engines, vertical type; fuel consumption. LPTolman. ProgressiveAge-10/1/08-584-4.7p*+; El'lRev-9/5/08-356-3p*+
- 11 Utilization of peat for making gas or charcoal, with recovery of by-products: conditions upon which present scheme depends; getting and drying peat; gas producers; by-products; peat charcoal. CapthRSankey. (Sec G, British Ass'n, Dublin, 9/7/08). Eng'g-9/11/08-355-4.7p*+

Water Power; Hydroelectric Plants. (See also 27, 50.)

- 12 110,000-volt transmsn into Grand Rapids, Mich: high-tension transmsn lines & generating stations of Grand Rapids-Muskegon (Mich) Pr Co; Croton Dam developmt; Rogers Dam pr plt; industrl use of pr. WesternEln-10/3/08-241-3.6p*+, 246-0.3p(Ed)
- 13 Surge tanks in water pr plts. RDJohnson. (Proc'dgs 6/08). Dis ProcAmSocMech'lEgrs-10/08-1035-54p+
- 14 Conservation & use of water-pr resources II: effect of water-pr conservation upon indust'l developmt; inland water transportation; water storage; developmt of available water prs for universal benefit. HvonShon. Eng'gMag-10/08-81-7.9p+

Railway Affairs... (See also 33-36, 40-41, 43-46, 52)

- 15 El ry egrg, VIII. Study in gear ratios shown by curves & tables. NWStorer. ElJrnl-9/08-510-9.9p+
- 16 Relation of rrs to the state: history in different countries; gen increase of state control, especially in US; control by Mexican gov't as a majority shareholder; state control vs ownership; how shall gov't regulate? WMAcworth (British Ass'n for Advancement of Science, Dublin, 9/2/08). RRAgeGazette-9/18/08-955-5.5p
- 17 Proposed elfn of Melbourne suburban rys: analysis of passenger traffic; schedule speed; rolling stock; gen estimates. Abs, rept ChasMerz, egr Victorian Rys Commnsrs. ElRyJrnl-10/3/08-751-4.2p+
- 18 Gen urban & interurban transportation & railless el traction (concl'd): the British mun trmwy system; handicap of heavy capitalization; statistics of 71 trmwys. FDFox. (British Ass'n, Dublin.) Eln-9/18/08-869-3.9p+; Eng'g-9/18/08-391-3.7p+, 372-0.8p
- 19 Ohio Valley Scenic Route: East Liverpool Traction & Lt Co; Steubenville & E Liverpool Ry & Lt Co; roadbed & track constrn; bridge & viaduct constrn; pr transmsn; pr houses & equipmt. ElRyJrnl-9/19/08-654-5.8p*+
- 20 Mchy of the purchasing dept. qualities and duties of the purchasing agent; outline of system & blank forms of Chicago City Ry. RBHamilton. ElecTractnWkly-10/3/08-995-5.1p+

Accounting.

- 21 Hearing on uniform system of accts for N Y rys. ElRyJrnl-8/1/08-383-1p, 369-0.5c(Ed), 8/8/08-439-5.6p
- 22 Depreciation in stm ry acctg: summary of views by various ry officials compiled by special com of Am Ry Assn. ElRyJrnl-10/3/08-748-1.1p
- 23 Valuation of property of pub service corps: method of computing property values. Abs, HLDoherty (Wis Gas Assn, 7/25/08). Eng'gRecord-9/5/08-274-1p

Miscellaneous.

- 24 Wages & hrs of labor in mfg industries, 1890-1907: data & tables; by occupations & geographical divisions, 1906 & 1907; relative

wages, 1890-1907; wages, hours by cities, in selected industries, 1906-1907. Bull of Bureau of Labor-7/08-1-180p+

- 25 Ports & exports of Puget Sound: Seattle a mun & commc'l marvel; Tacoma, great mfg & jobbing center. ECawcraft. Book-keeper-10/08-253-8.5p*

Book Accessions.

- 26 The use book. Regulations & instructions for the use of the national forests. Administrative edition. U S Forest Service. 341p, 4½x6½, 1908. *6882.Us2
- 27 Water prs of Wisconsin. LeonardSSmith. Wis Geological & Natural History Survey. Bull No. 20. 354p, 7x10, illus, maps, 1908. *2800.0732. Sm5
- 28 Tide tables for Atlantic Coast of the U S including Canada & the West Indies. Reprinted from tide tables for 1908. Coast & Geodetic Surv. 168p, 7x10½, 1907. *6897.T43
- 29 Rept of Commr of Corpsns on the petroleum industry. Part I: Position of the Standard Oil Co in the petroleum industry. Dept of Com & Labor, 5/20/07. 396p, 6x9, maps. *6892.P44
- 30 Superheat, superheating & their control: properties of stm; types, uses & economy of superheaters; feed-water heating. William H. Booth. 155p, 6x9, illus, 1907. *.072.B64
- 31 Mineral industry: its statistics, technology and trade during 1907. Vol XVI supplementing Vols I to XV. WalterRentonIngalls. 1127p, 6½x9½, illus, 1908. *075.M66.1907
- 32 Contributions to economic geology, 1907. Part 1: Metals & non-metals, except fuels. CWHayes & WaldemarLindgren. U S Geol Surv, Bull No. 340. 482p, 6x9, maps. 1908. *6874.B340
- 33 Motorman and his duties. A handbook of the theory and practice of el ry car operation. Ludwig Gutmann. Ed 6 revised & enlarged by LawrenceEGould. 195p, 5x8, illus. *07127.G98
- 34 How to become a successful motorman. SidneyAylmer-Small. 312p, 4½x6½, illus. *07127.Ay4
- 35 How to become a competent motorman. A practical book on the proper method of operating a st ry motor-car; with instructions how to overcome troubles on the road. VirgilBLivermore & JamesRWilliams. Ed2, 247p, 5x6½, illus. *07127.L75
- 36 Austin Electric Railway System; description & test of pr plt: rolling stock & track; electrolysis test. A thesis by Louis RobertPietzsch, EdwinDavisSanders, EverettDeFauPhillips & GeorgeWallaceSmith, 1906. Bull of Univ of Texas, No. 81. 123p, 6x9, illus. *5261.0712
- 37 Cotton mills of So Carolina: wages; no of spindles; capitalization; child labor; welfare work. AugustusKohn. S C Dept of Agriculture, Commerce & Immigration. 228p, 6x9, 1907. *3400.024
- 38 Crop repts & general business conditions; as they exist today as seen by some 4000 bankers & business men. 8th an rept, 1908. Compiled by The Commercial Nat'l Bank of Chicago. 112p, 6x9, nd. *2731.027.B22.1908
- 39 On mun & national trading: disadvantages; rrs, lt & pr; political influences adverse to efficient management. LordAvebury. 176p, 5½x8½, 1907. *.029.Av3
- 40 9th an rept of the N Carolina Corporation Commns, 1907: rrs; electric rys; telephone & telegraph cos; banks. 582p, 6x9. *3304.1907
- 41 Procdgs Ann St Ry Assn, 3rd-24th, 1884-1905. *6940.1884-1905
- 42 Rept of Dept of Mines of Pa. 1905, 1906. Parts I-Anthrachte. Parts II-Bituminous. 6x9, maps. *1801.1905.1&2, 1906.1&2
- 43 4th an rept of the Corporation Commns of Va. Part II-Compilations from returns of canals, railroads, electric rys, and other corporate companies. 1906. 1376p, 6x9, 1907. *2304.1906.2

- 44 Rept of Pub Serv Commsn for First Dist of State of N Y for six mos end 12/31/07. Vol I: Rept. 793p, 6x9, 1908. *1704.058
- 45 First an rept Pub Serv Commsn, 2nd Dist. State of N Y, for six mos end 12/31/07. Vol II: Abs of repts of corpn. 267p, 9½x12, 1908. *1705.1907.2
- 46 First annual rept of Pub Serv Commsn, 2nd Dist. State of N Y for six mos end 12/31/07. 745p, 6x9½, 1908. *1705.1907
- 47 Factory management: office routine; purchasing; cost keeping; stock room; employees records; department reports, etc. Chas BCook. 215p, 5½x8, illus, 1906. *08.C77
- 48 First an rept on comparative financial statistics of cities & towns of Mass, covering mun fiscal yrs ending between Nov 30, '06 & Apr 1, '07. Cost of mun gov't in Mass: current expenses in detail; receipts & payments; debt & sinking funds. Bur of Statistics of Labor. 299p, 6x10, 1908. *1402.M92.1906
- 49 Census of Commonwealth of Mass, 1905. Vol III: Manufactures & trade. Bur of Statistics of Labor. 294p, 6x10, 1908. *1400.026.1905.3
- 50 Handbook of So Carolina. Resources, institutions & industries of the State; water pr; mfres; principal cities; population, etc. Dept Agric, Commerce & Immigration. Ed2, 615p, 6½x10, illus, maps, 1908. *3406.065
- 51 Fairbanks & Rampart quadrangles. Yukon-Tanana Region, Alaska. LMPrintle, with section on Rampart placers by FLHess & a paper on Water supply of the Fairbanks region, CCCovert: geology; climate; stream measurements. U S Geol Surv, Bull No. 337. 102p, 6x9, maps, 1908. *6874.B337
- 52 Complaint of AEBuell vs Chicago, Milwaukee & St Paul Ry Co before RR Commsn of Wis. Decision No. 32: question of reasonable rates; power of the Commsn to fix rates; interstate earnings not considered in fixing interstate rates; separation of freight & passenger earnings. 191p, 6x9, (1907). *2804.D32
- 53 Index of economic material in documents of the states of the U S. Mass, 1789-1904. AdelaldeRHesse. Carnegie Institution of Wash. 310p, 9x12, 1908. *096.C22.3
- 54 Directory of City of Houston, Tex, 1908-09. Morrison & Fourmy Directory Co. 510p, 7½x10½, 1908. *5281.1908
- 55 Nelson's Encyclopaedia. Everybody's book of reference in 12 volumes, profusely illustrated. Editors-in-Chief FrankMoore Colby, MA, New York; GeorgeSandeman, MA, Edinburgh. Revised 1907 by Nelson's editorial staff. ThomasNelson&Sons. 1907. 8x10½, 1907. *091.N33.1-12

FOS/AJF

10/14/08

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The Lowell Electric Light Corporation	Whatcom County Railway & Light Company
The Minneapolis General Electric Company	Houston Electric Company
The Blue Hill Street Railway Company	Jacksonville Electric Company
The Seattle Electric Company	Savannah Electric Company
Edison Electric Illuminating Company of Brockton	Fall River Gas Works Company
Puget Sound Electric Railway	Ponce Electric Company
Houghton County Electric Light Company	Dallas Electric Corporation
Tampa Electric Company	Galveston Electric Company
Columbus Electric Company	Paducah Traction and Light Company
Brockton and Plymouth Street Railway Company	Northern Texas Electric Company
Pensacola Electric Company	The Key West Electric Company
Cape Breton Electric Company, Limited	Puget Sound International Railway & Power Company
Houghton County Traction Company	The Electric Light and Power Company of Abington and Rockland
El Paso Electric Company	Baton Rouge Electric & Gas Company
Pacific Coast Power Company	

STONE & WEBSTER BUILDING

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STONE & WEBSTER PUBLIC SERVICE JOURNAL

DECEMBER 1908

EDITORIAL COMMENT

Mr. Lee H. Parker's article in the October Journal on "Light vs. Heavy Cars for Street Railway Service" has elicited a reply from Mr. W. H. Huelings, Jr., of the J. G. Brill Company, which will be found elsewhere in this issue. Appended is a brief comment by Mr. Parker. We take this opportunity to express our gratification over the discussion that has been excited of this highly important subject.

* * *

Mr. P. A. Staples' article in this number on "Historic Forest Fires" will, we venture to assert, prove a revelation. It is devoted primarily to a discussion of the economic aspects of the forest fires of 1908, but the real character of these fires is the more clearly shown by contrasting them with the great historic fires of the past. Mr. Staples traces both the direct and the indirect results of these conflagrations, and finds them nothing short of frightful, when reduced to the terms of money.

* * *

The editor of the "Harvard Illustrated Magazine" has granted us permission to reproduce from the October number of that publication Gen. Bancroft's remarks on "Street Railway Transportation as a Career for the College Man." Street railroading, as the president of the Boston Elevated Railway Company says, offers an attractive career to well-qualified young men; it is a business of distinctly professional character; it has prizes for ability and

integrity; nowhere else are ideas more in demand, or executive capacity more adequately appreciated. The value of Gen. Bancroft's paper resides in the fact that it points out just what circumstances should be taken into account by a young college man who is attracted by the possibility of serving society in an urban transportation capacity. We find here a long series of practical considerations,—in short, just the right kind of advice for young men who mean business.

"A Private Business."

A few weeks ago the daily papers circulated the rumor that the Outlook, for which President Roosevelt is to write after the expiration of his term, is largely owned and controlled by Mr. James Stillman, who is popularly supposed to be a backer of Mr. Harriman and a prominent member of the "Standard Oil group." It was promptly and authoritatively stated that Mr. Stillman had never owned so much as a tenth of the stock of the Outlook, and the rumor had the appearance of being an unfair attempt to give the President a bad half hour.

The real interest in the episode is in the interview with Mr. Howland, the treasurer of the Outlook Company. "The Company is not a public service corporation" was the reply of William B. Howland, treasurer, and one of the directors of the Outlook Company, when he was questioned regarding the authenticity of the report. "It is under no obligation to give the names of its stockholders or other particulars regarding its affairs. It is a private business * * * *."

Such a statement, coming so directly, is something of a shock to those of us who have been learning much of late years about the ethics of business from the Outlook, and from other earnest workers for advancement.

It is perilously like the statements of a decade ago, made by the men who thought then that theirs was a private business, but who have since been made to see the light. We fear Mr. Howland has been too much engrossed in his duties as treasurer to absorb from the Outlook those new ideals of public service and the new spirit of responsibility toward society that have been so helpful to those managing "public service corporations."

In times of irritating and seemingly impertinent inquiry, there is doubtless a strong temptation to fall back on one's legal

rights, and to assume that one has affairs that are nobody's business; but the public service corporations can tell Mr. Howland how surprisingly easy after all it is to renounce such prerogatives, and how natural it becomes after a little practice to reply to all questions, however private they may seem, with perfect openness and willingness.

It is splitting hairs to say that the Outlook's affairs are private; it is making an untenable distinction to say it is not a public service corporation; such a contention is but a reversion to that highly technical position abandoned in the advance of corporation ethics, by the railroad, light, telephone, water and power companies.

In a superficial view of the matter it may seem that there is an essential difference; that the Outlook is granted no privileges by nation, state or city. It is rash in these days of social dependence to claim that any business or any individual is without privileges, but how plainly false would be such a claim on the part of a periodical like the Outlook. It receives a privilege from the Government without which it could hardly live—no mere permission that costs the Government nothing directly, like the stringing of a wire or the laying of a rail, but a very valuable privilege that costs the Government annually a very large amount of money. The Government grants to the Outlook the privilege of having its copies distributed throughout this country by paying 1c. a pound. It does this because of the nature of the service that periodicals like the Outlook render—because this service is public service. It does not give this subsidy to the Stone & Webster Public Service Journal, for instance, because we are supposed to be working for a private interest. We are accordingly charged 8c. a pound, and a privilege like that granted to the Outlook would be worth thousands of dollars a year even to so modest a publication as the Public Service Journal.

We have no intention of attempting to make the point that the Government should not tax the people to pay the Outlook a subsidy of 2c. or 3c. on each copy that it mails—\$1 to \$1.50 a year per subscriber. There is much evidence to show that this sort of expense has been worth what it has cost the people, and we believe the Outlook has well met the responsibility that this privilege imposes, but it makes one rub one's eyes to have Treasurer Howland draw himself up as we of the public service corporations have learned not to do, and say his is a private business.

The Chicago Failure in Municipal Lighting

On November 9 Mr. Fred A. Busse, mayor of Chicago, sent to the city council the information previously demanded by that body with reference to the initial cost and present value of the city's electric light plant and the cost to the city of lighting its streets with its own plant. This information was in the form of reports by Bion J. Arnold, consulting electrical engineer, and Arthur Young, certified public accountant. The showing will be of interest to every part of the country.

Stated as briefly as the situation will allow, the facts are as follows: The total amount of money expended on the electric lighting plant from the inception down to August 1, 1908, was \$3,639,031.47. The replacement value, as determined by the engineers' appraisal, was \$2,353,869.10. Taking the original cost to the city as determined from the vouchers by the accountants, and deducting annual depreciation at the rates established by the engineers for the use of the accountants, the plant showed a value as of August 1, 1908, of \$2,603,144.22; the engineers' appraisal value as of the same date was \$2,353,869.10; a difference of \$249,275.12. At this point let us quote the exact language of the report, the italics being ours: "This difference may be explained by the fact that, *if the city had* written off annual depreciation at the rate established by the engineers for the use in the accountant's report, and *if it had* placed this money in a sinking fund, it would today have had enough unexpended money in that fund to offset the above difference of \$249,275.12." Note what an important part the word *if* plays in this transaction.

Last year (1907) it cost the city \$81.64 to maintain each of the 7,647 street lamps supplied by the municipal plant, as against \$75 per lamp for 10,000 additional lights obtained from the Commonwealth Edison Company.

Now as regards the future. On July 15, 1907, the city of Chicago contracted with the Sanitary District for the purchase of alternating current for city lighting. Again quoting the report: "The city has now replaced a large number of old type direct current arc lamps with more modern and economical alternating current lamps. Alternating current substations have been provided and connected up for operation with current taken from the Sanitary District substation. The direct current equipment still retained in the lighting service is now driven by motors also oper-

ated by the Sanitary District current. The saving effected by the alternating current system points to the desirability of extending the alternating current equipment, not only to take care of all additions to the lighting system, but as well to replace all of the remaining direct current equipment." This it is estimated will reduce the cost per lamp to \$60.56, but, it is added, this reduction will not be realized during the year 1908. The report declares that in case the entire alternating current system is installed and supplied with power from the Drainage Canal, the cost would be \$42.17 per lamp per year. This, of course, is contingent upon the canal's power to furnish the necessary energy at the present contract rate. A salient fact is that such reduction in cost implies the replacement of all the old equipment of the municipal plant and the discontinuance of the present steam plant. It is for such reasons that we find at least one western newspaper discussing the situation in such terms as "Nearly \$4,000,000 Sunk."

Perhaps the most interesting feature of this whole situation is the language it has evoked from Mayor Busse of Chicago. The "Minneapolis Journal" of November 9 quotes him as discussing the deficiency of municipal administration as follows:

"A city employee seems to think that he is required to do only about one-fifth of a day's work. Go out in the street any day and watch the employees of an electric light and power company putting up wires and other equipment. Then go over to the next street and watch the city electricians doing similar work. You will see the difference in the amount of work the company is getting and the amount the city is getting." On being asked why he did not reform the department and put it on a business basis, he replied: "Reform nothing: A private company can discharge inefficient employees, but the city can't. To get rid of inefficient employees I have to file charges minutely specifying their shortcomings and then the civil service commission puts me on trial instead of the employees. I am a strong advocate of civil service—I think it is absolutely necessary in the administration of government—but there are some defects that must be remedied before the executive will have it in his power to run the government so as to give the people their money's worth."

No one can study the report made by the Mayor to the city council of Chicago on November 9 without being struck by the closeness with which it confirms certain statements made some months earlier in a report on street lighting by the lighting com-

mittee of "The Civic League" of St. Louis. The committee said, among other things, "The danger of partisan politics in the management and operation of the plant, which tends to reduce its efficiency and increase its cost, indicates the inadvisability of municipal ownership except as a last resort." And again, "The economy of municipal operation and control has not yet been proven in this country—only two of the first ten cities, Chicago and Detroit, have attempted it. The experience of these two cities is not such as to warrant the statement that a municipal plant would be more economical than contract lighting."

CAPITALIZATION AND EARNING POWER OF STONE & WEBSTER STREET RAIL- WAY COMPANIES

By A. S. MICHENER*

In considering the advisability of purchasing any investment security, an investor naturally wishes to know how the company represented by that security compares with other companies in the same line of business. An analysis has been made of the capitalization and earning power of street railway companies in the United States, with a view to ascertaining the relative strength in that regard of street railway companies under the management of Stone & Webster. This analysis was confined to companies reporting annual gross earnings between \$200,000 and \$10,000,000 for fiscal years ending with or during 1907. The minimum was placed at \$200,000 in order to eliminate the great number of smaller companies of minor financial importance. The maximum was placed at \$10,000,000 for two reasons: first, to eliminate some of the great city systems with capitalizations so large as to unfairly reduce the average for all companies; second, because in order to get fair comparisons it would have required the capitalization of rentals paid by some of these great systems for subway operations, etc.

Published reports could not be found of all the street railway companies in the United States doing an annual gross business between \$200,000 and \$10,000,000, but the missing companies are very few. Of those reporting, not all of them gave all of the information desired respecting capitalization and earning power. It was possible, however, to find:

1. The ratio of Outstanding Total Capitalization to Gross Earnings, for 143 companies.

*Comptroller, Stone & Webster.

2. The Ratio of Outstanding Funded Debt Capitalization to Gross Earnings, for 139 companies.
3. The Ratio of Net Earnings to Interest Charges, for 127 companies.
4. The Per Cent. Earned on Outstanding Preferred Stock, for 68 companies.
5. The Per Cent. Earned on Outstanding Capital Stock, and the Per Cent. Earned on Outstanding Common Stock, above amount required for preferred dividends, for 139 companies.
6. The Increase in Gross Earnings of 1907 over 1906, for 148 companies.

For the above information, the states and territories of the Union furnished the following number of companies:

Alabama	2	Kentucky	3	New York.....	26
Arkansas	2	Louisiana	1	North Carolina..	2
California	2	Maine	4	Ohio	16
Colorado	2	Maryland	1	Oregon	1
Connecticut	1	Massachusetts ..	12	Pennsylvania ...	20
Dist. of Columbia	3	Michigan	3	Rhode Island...	1
Delaware	1	Minnesota	2	South Carolina.	1
Florida	3	Missouri	4	Tennessee	4
Georgia	4	Mississippi	1	Texas	4
Illinois	8	Montana	1	Virginia	3
Indiana	4	Nebraska	1	Washington	4
Iowa	6	New Hampshire.	1	Wisconsin	3
Kansas	2	New Jersey.....	3		
					Total....
					162

It will thus be seen that the results obtained are representative of the entire country, and are not confined to any particular section or sections.

In compiling the six tables referred to above, the companies were arranged in the order of best showing. In each of these lists nearly all of the Stone & Webster companies are found among those appearing at the head of the list, and taken together their strength in each instance is far superior to the average for all companies.

Following are summaries of the comparative tables.

(1) Ratio of Outstanding Total Capitalization to Gross Earnings.

	No.	Outstanding Total Capitalization	Gross Earnings	Ratio
Stone & Webster Cos...	14	\$77,939,246	\$12,284,529	6.3 to 1
Other Companies.....	129	1,241,145,931	147,768,305	8.4 to 1

All Companies.....143 \$1,319,085,177 \$160,052,834 8.2 to 1

(2) Ratio of Outstanding Funded Debt to Gross Earnings.

	No.	Outstanding Funded Debt	Gross Earnings	Ratio
Stone & Webster Cos...	13	\$35,499,186	\$11,763,348	3.0 to 1
Other Companies.....	126	616,144,024	145,438,578	4.2 to 1

All Companies.....139 \$651,643,210 \$157,201,926 4.1 to 1

(3) Ratio of Net Earnings to Interest Charges.

	No.	Net Earnings	Interest Charges	Ratio
Stone & Webster Cos...	13	\$3,971,845	\$1,897,736	2.1 to 1
Other Companies.....	114	46,016,388	29,443,010	1.5 to 1

All Companies.....127 \$49,988,233 \$31,340,746 1.6 to 1

(4) Per Cent. Earned on Outstanding Preferred Stock.

	No.	Outstanding Preferred Stock	Profit	Percent
Stone & Webster Cos...	13	\$14,848,600	\$1,864,029	12.5
Other Companies.....	55	162,373,977	13,154,493	8.1

All Companies..... 68 \$177,222,577 \$15,018,522 8.4

(5) Per Cent. Earned on Outstanding Capital and Common Stock.

	No.	Outstanding Cap. & Com. Stock	Profit	Percent
Stone & Webster Cos...	14	\$27,591,460	\$1,124,134	4.0
Other Companies.....	125	447,255,573	10,869,753	2.4

All Companies.....139 \$474,847,033 \$11,993,887 2.5

(6) Per Cent. Increase in Gross Earnings, 1907 over 1906.

	No.	1907	1906	Increase	Percent Increase
S. & W. Cos..	14	\$12,284,529	\$10,250,735	\$2,033,794	19.8
Other Cos....	134	165,624,793	150,878,052	14,746,741	9.7
All Cos....	148	\$177,909,322	\$161,128,787	\$16,780,535	10.4

The largest of the Stone & Webster companies is The Seattle Electric Company with gross earnings in 1907 of \$3,949,434. Taking into consideration its relative standing in all six tables, and comparing it with all companies having gross earnings in excess of \$2,500,000 (of which there were from 16 to 20 in the several tables), The Seattle Electric Company makes the strongest showing, standing

Second in low ratio of Outstanding Capitalization to	
Gross Earnings, with a ratio of.....	4.7 to 1.
First in low ratio of Outstanding Funded Debt to Gross	
Earnings, with a ratio of.....	2.1 to 1.
Tied for first in high ratio of Net Earnings to Interest	
Charges, with a ratio of.....	2.9 to 1.
Fourth in Per Cent. Earned on Preferred Stock, with a	
percentage of.....	15.5
First in Per Cent. Earned on Common Stock, with a	
percentage of.....	9.5
First in Per Cent. Increase in Gross Earnings, 1907	
over 1906, with a percentage of.....	27.3

In a comparison of gross earnings for the first six months of 1908 and 1907, the Stone & Webster companies again make an excellent comparative showing.

	No.	Jan. 1 to June 30th, 1908	Jan. 1 to June 30th, 1907	Increase	Percent Increase
S. & W. Cos.	14	\$6,104,320	\$5,691,522	+\$412,798	+7.25
Other Cos...	32	32,191,108	31,281,221	+909,887	+2.91
<hr/>					
Total	46	\$38,295,428	\$36,972,743	+\$1,322,685	+3.57
<hr/>					
Steam Rail-					
roads. 141		\$863,860,965	\$1,036,729,560	—\$172,868,595	—16.58

HISTORIC FOREST FIRES

By P. A. STAPLES.*

The forest fires which this year have so ravaged the country in general, and the lake states in particular, have undoubtedly been brought to the attention of every man by the stories of hairbreadth escapes and horrible deaths which have appeared in the newspapers. These make an impression; but do the majority of men realize the great economic loss occasioned to the country in general by the destruction of property, loss to new growth, loss of soil fertility, damage to river courses and adjacent farm country, and by the general depreciation in forest wealth and land values?

We will deal first in this article with some of the historical fires and with the fires of 1908 as occurring in the lake states particularly, and then see what the actual losses have been to the country, together with the suggested causes and remedies. The writer wishes here to express his appreciation of the assistance rendered him by Mr. R. W. Pullman of the U. S. Forest Service, who has supplied much of the information contained in this article.

In the early seventies, Wisconsin and Michigan were visited by fires which have gone down in history. The Peshtigo, Wis. fire, named after a town of two thousand inhabitants, which was entirely destroyed, entailed a loss of many millions of dollars' worth of property and timber. This fire covered an area of over two thousand square miles, and approximately one thousand five hundred people perished with their property. In Michigan, a strip about one hundred and eighty miles long and forty miles wide, extending from Lake Huron to Lake Michigan, was devastated. Several hundreds of persons perished. The estimated loss in timber was about four billion feet board measure, and in money \$10,000,000.

Both of these fires were worse than the historic Miramichi (New Brunswick) fire of 1825 which destroyed in nine hours a belt of forest eighty miles long and twenty-five miles wide, or more than 2,500,000 acres. Five hundred and ninety buildings were burned, and one hundred sixty people, and nearly one thou-

*Contract Agent, Houghton County Electric Light Company.

sand head of stock perished. Even the fish were found dead in heaps on the banks of the stream, and the timber loss was inestimable.

In the year 1881, more than eighteen hundred square miles were burned over in Michigan alone. In these fires, over five thousand people were made destitute and great loss of life resulted. The property loss was more than \$2,300,000, not including the timber, which numbered many hundreds of thousands of acres. The district around Hinckley, Minnesota, in 1894, suffered a loss estimated at \$25,000,000; seven towns were destroyed; two thousand people were left destitute, and four hundred lives were lost. These fires, it must be remembered, were not the only ones occurring during this period, but simply stand out from the somber background of the rest on account of their violence.

So far this year, it has been impossible to form accurate figures as to the losses, but, from the data already at hand, it is estimated that the loss in the lake states is the worst since the Hinckley fire of 1894, and probably more extensive than from any of the fires of the last quarter century.

One of the many sections ravaged this fall was in the neighborhood of Hibbing, Northern Minnesota. A conservative estimate puts the loss at between \$5,000,000 and \$10,000,000. Chisholm, a town of five thousand, suffered a loss of approximately \$1,500,000 in real property and merchandise. Metz, a small village, was entirely wiped out, twenty people losing their lives. In one township alone, ninety-six farms were entirely devastated.

In the upper peninsula of Michigan, while no towns were destroyed, the losses in farms and timber, both cut and uncut, were very heavy. Many of the mining locations and small towns were threatened, in some cases it being found necessary to shut the mines down in order that the men might be used to fight the fires. This large supply of men, combining with the fire departments of the nearby towns, undoubtedly saved the section of the country from great property losses. The timber losses have not as yet been estimated, but, from every county and section, come reports of great damage done. What is true of the Upper Peninsula also applies to the rest of the lake states. The fires were not great holocausts like some of the historic fires, but the losses will mount up to millions of dollars in each state.

It has been urged and argued in many articles that the reported losses are exaggerated, and that the greater part of the

forest burned consisted of small growth and brush. This may be true to some extent, but what can be expected in the way of future forests if the seedlings and small growth are continually ravaged? It is estimated that each year, in the United States, the loss to new growth amounts to \$80,000,000, due to past forest fires. Up to the year 1880, ten million acres were being burned over per year. The value of the actual timber destroyed was estimated at from twenty-five to fifty millions per year. The acreage now desolated is, to be sure, less; but since this time the value of stumpage has increased at least five times, so that, at the present date, the actual money loss has increased.

We have touched so far, with the exception of the question of loss of new growth, on direct losses only. The indirect are, unquestionably, as important, for every fire carries with it the impoverishment of the whole region for years. The loss of soil fertility is inestimable. Reports have been made on sections where the ground is simply a bed of ashes from one to two feet thick. The spring floods and summer droughts are due, partially, to this cause, and cost each year many millions of dollars. The wages paid to the lumberman, the price paid to the farmer and the merchant for supplies for the lumber camp, and the revenue to the state from taxes devoted to roads and other public improvements, all swell the total costs to a region when its forests are devastated.

It is natural, now, to look for the causes, which can be summed up in the one word "CARELESSNESS." The camper leaves his fire, the hunter drops his cigar, the farmer leaves his brush burning, railroad employees fail to report a small fire started by a locomotive spark, the people living in small villages or on farms do not attempt to extinguish a fire until it becomes an active menace; all these are causes, and they are augmented by lack of interest and carelessness on the part of the lumberman, who does not clean up or burn the slashings. And this is peculiar, for although these classes may not appreciate the loss to the country in general, they are themselves personally affected. Of what good is a country full of blackened stumps, dead vegetation, and half-burned trees to the camper or hunter? Can the farmer expect successfully to raise products on lands whose fertility is materially decreased and whose lowlands are subject to spring floods? Did any railroad ever derive profit from such a district? Will the lumberman ever make a second cut; and, finally, will the state, or in other words the people in general, receive any revenue from

such a section? The answers to these questions are obvious, but, unfortunately, the remedies are not.

Many states have passed protective measures which in many respects are good so far as they go, and to the extent to which they are enforced. The federal government has reduced the losses in the national forests to an insignificant amount by careful patrol, by the co-operation of settlers and the users of the forests, and by the organization of a force to fight fires as soon as discovered. Immediate action as soon as a fire is discovered seems to be the keynote of the situation. It is stated, and on good authority, that both the burning of the town of Hinckley in 1894 and that of Chisholm in 1908 were entirely unnecessary; that in both these cases the fires were burning slowly in the forests for over a week with practically no attempt made to put them out. What is apparently needed is a trained, non-political forest expert in every timbered district (with authority to deputize assistants) to see that the fires are fought before they are actually a menace. This, combined with a general campaign of education and publicity to impress upon the different classes their responsibilities and to secure their co-operation, should do much in the future towards the preservation of the country's forests.



PENSACOLA—A CITY OF “MANIFEST DESTINY”

The “manifest destiny” talk in the United States may be said to have come into use in connection with Pensacola. Forty years ago there was a variant on “Yankee Doodle” which contained these lines:

It is a fact, by Jingo,
He'll take all North America,
And maybe San Domingo.

But that was only a new adaptation of a sentiment widely voiced sixty years previously. The “taking” began in the second decade of the nineteenth century. Hardly was the republic of the United States on its feet when our political leaders prognosticated for it a vast territorial expansion. In 1803 occurred the first opportunity. The first Napoleon found himself hard up for cash to pursue his conquering career, and in looking about to see what assets he had that could be converted quickly into dollars and cents—to be more exact, into francs—he hit upon Louisiana. To sell to us the west bank of the Mississippi to the very Pacific for fifteen millions of dollars was to him a stroke of genius; to us it was certainly such a stroke of luck as the world has seldom seen. That was our first expansion; it was, however, a matter of purchase and sale. But ten or fifteen years later we “took” Florida—and it was at Pensacola that the affair occurred. It was Andrew Jackson's march to that place that first really opened our eyes to the “manifest destiny” of the United States.

Probably no town or city in the United States has had so changeful a career as Pensacola. It has occupied four different sites; it has shifted with marvellous frequency from the hands of one nation to those of another; seven times it has been attacked and captured; twice the place was abandoned, once for one hundred and fifty years. Eighty-seven years ago its vicissitudes were practically ended; it then became part of the United States.

Pensacola has not hesitated to assert her claim to being the oldest city in the United States. In 1516, twenty-four years after Columbus launched his adventurous barks on the western seas, one Diego Miruelo, a Spanish pilot and trader, sailed into a magnificent bay which posterity has identified with Pensacola harbor. He made no settlement, however. But in 1559 a colony of two thousand persons was sent from Cuba and settled somewhere on the shores of the bay. This was four years before the founding of St. Augustine; hence, Pensacola's claim to chronological priority among American cities. This, it must be confessed, is rather a shadowy claim, as the settlement was abandoned after two years. Nearly one hundred and fifty years elapsed before a second move was made. In 1696 the French were getting to be uncomfortable neighbors. They were working down the Mississippi, and Spain saw that if something was not done on the instant they would soon be landed in Florida. Consequently a Spanish fort, called San Carlos, and a few houses were built at the spot now known as Barancas. Three years later the French arrived, and finding the Spaniards there, sailed off and founded Mobile. Thus it will be seen that this second founding of Pensacola was merely a strategic move to preserve Spain's title to West Florida. In 1719 France and Spain went to war and the French promptly pounced on Pensacola and shipped the Spaniards off to Havana, whence, however, they shortly returned and ejected the intruders, only, after a month's delay, to be turned out a second time. The affair was settled by diplomacy in 1722, when the town was handed back to Spain. It may be said that about all the Spanish recovered was the ground; the town had been wiped out. The place was rebuilt, but this time on Santa Rosa Island, which bears about the same relation to the mainland that Long Island bears to the coast of New York and Connecticut. Not much is known of this settlement. It appears to have consisted of a single street, a fort, a church, a government residence, and a dozen houses. It doesn't matter much what it was like, for it was swept away by hurricane in 1754. Then the occupants moved over to the mainland and rebuilt on the present site.

Nine years later Pensacola began to amount to something. In 1763 the Treaty of Paris brought to a close the French and Indian war, and under the treaty Florida passed to the hands of the British. Pensacola was at once made the capital of British West Florida, which stretched from the Chattahoochee to the Mississippi



and extended farther north than Montgomery. Social and political importance was thus given to the town and a flourishing trade sprang up with the Indians. Pensacola, as the British found it, was a wretched affair of less than fifty huts. Immediately, however, the place began to acquire the topography which it possesses today. But in 1779 Spain was again at war with England, and an expedition was sent from Louisiana against the town. A bombardment ensued and Pensacola once more became Spanish.

In 1814 began that series of events which made Pensacola a city of the United States. The Spanish power in Florida was so contemptibly weak that the British had no hesitation in making Pensacola a base for their operations against the Americans during the 1812 war. This led to summary measures on the part of Gen. Andrew Jackson, who marched 5000 Tennesseans against the town and took possession of it. After two days he withdrew, but for several years longer Spanish West Florida remained a thorn in the flesh to the American republic. The Spanish made no serious attempt to restrain the Florida Indians from aggressions on American soil. Finally the patience of this country, and particularly of Andrew Jackson, the general in command against the Indians, was exhausted, and Jackson once more occupied Pensacola, in May, 1818. He set up a provisional government and held the territory for fourteen months, when it was handed back to Spain. Obviously this was a situation demanding permanent rectification, and this was effected in 1821, when Florida was ceded to the United States for good and all.

So Pensacola became an American town. Yet very little is recalled of what took place there from that period to the Civil War. During the great war the town was very much in the public eye. The Confederates acquired control of the forts and the navy yard on the mainland, but the Federals retained possession of Fort Pickens on Santa Rosa Island, which resulted in an evacuation of the town in 1862. In leaving, the Confederates burned the navy yard, the public buildings, the saw mills, and all the lumber they could lay their hands on. When the war began Pensacola contained in the neighborhood of 3000 persons, and when it was evacuated by the Confederates many of the inhabitants left for other localities.

It was on such a foundation that the modern city of Pensacola was built up. It took nearly three hundred years to get it upon its feet; but once there, it began in quite lively fashion to

justify its existence. In 1880 its population had increased to 6845; in 1900 to 17,747; and today it contains not far from 27,000 souls. This rapid expansion may be traced to the great development that has taken place in southern Georgia and Florida. When the real development of Pensacola began West Florida was heavily timbered with yellow pine, and getting this timber out for market naturally became the first industry of importance; not until the country was cleared could agricultural efforts be conducted on an extensive scale. In time the lumber industry assumed considerable proportions; large mills grew up in Pensacola, and the surrounding country was dotted with small plants. In the wake of lumbering came the development of the turpentine industry. The removal of the timber has prepared the way for fruit raising and truck gardening, for which the soil was found to be admirably adapted. The railroad facilities at Pensacola are practically controlled by the Louisville & Nashville, which has here three of the largest export wharves in the world.

From this may be inferred that the shipping business of Pensacola is growing apace. The articles exported, in order of their importance, consist of cotton, lumber, sawn timber, phosphate rock, naval stores, coal, tobacco and cotton seed oil, and from the varied character of this list it will be seen that the port is a distributing point for a territory extending far into the interior. In 1907 the exports amounted to \$19,463,564, as against \$16,258,732 in 1905. The city is the greatest fresh fish market on the Gulf of Mexico, the industry employing over 75 vessels. Its general merchandise business, outside of its export business, is on an extensive scale and covers a large territory. The city is equipped with four national and one state bank.

It is, in a word, in such shape as to take a great start at any moment. It is quite within the limits of probability that the not remote future will bring it into direct connection with the Illinois Central, the Southern and the Seaboard Air Line railroads, all of which are at present within striking distance. Its close proximity to Baldwin County, Ala.—a region renowned for its garden truck and its high grade tobacco—should prove a very valuable commercial asset, so soon as the necessary railroad facilities are provided. The opening of the Panama Canal should, it would seem, impart an enormous stimulus to Pensacola, this city being the most direct port of shipment on the Gulf to the Isthmus. The iron and cotton and cotton manufacturing industries of the South will, it may



confidently be predicted, find steadily increasing markets on the Pacific, canal or no canal. There can be no doubt, however, that this movement will be greatly accelerated by the opening of the Panama Canal. When that occurs the iron products of Birmingham, and the cotton goods of a whole tier of southern states should tend naturally toward Pensacola as their export point.

The old explorers of this continent were very shrewd in their selection of locations for settlement. A land-locked harbor was highly prized by them. There could be no doubt in the minds of the early Spanish navigators of the eligibility of Pensacola harbor for a great trading centre. This sheet of water is not only land-locked, but big and deep as well. It is thirty miles long and three to six miles broad, with a depth of thirty-three feet at low tide—the deepest harbor, in fact, on the Gulf or the South Atlantic. Its narrow entrance makes it easy of defence.

So far as its physical and social features are concerned, Pensacola is a very charming place. The shores of the bay are low and are given up to industry, but soon a gentle grade is encountered, culminating at quite an altitude, and here we find the residential quarter. Pensacola has all the gracefulness that comes from age and inherited wealth. The amenities of life have a large place there. The streets are broad and beautifully shaded by live oaks of old and large growth. The public squares are unusually picturesque and are well cared for. The business section has a solid and prosperous appearance; its architectural pretensions are already notable, and are becoming more so every year. The residential quarter has many features of elegance; as a place of abode, Pensacola is a very ingratiating city. Life is exceedingly enjoyable there; the town has such a look of refinement, its people are so self-respecting, the climate is so enjoyable, the bay and the sand dunes and the foliage and the old forts are so picturesque, that one may be congratulated who has to spend his time in that corner of the United States. In the way of churches, schools, clubs and means of diversion the city is admirably equipped. Two essential features of a community are its sewerage and its water supply. Pensacola is a thoroughly modern city in both particulars. Its sewerage is hygienic, its water is delightful.

It was in 1906 that the Stone & Webster organization took charge of the traction and electric lighting systems of Pensacola, both of which it has improved. At that time there was a line seven and one-half miles along the shore to Fort Barancas—that

is, to the government reservation, where the navy yard is located, and where a good-sized colony exists. This line was electrified for only about a third of the distance, steam being employed over the balance. Today, electricity is the sole power. The city lines of the old company were in inadequate condition, but the situation in this respect has since been much improved. All told, the street railway company now operates 20.39 miles of track. Its equipment consists of 26 passenger cars, with 9 trailers, together with one express car and 11 miscellaneous cars. Power for both the street railway and lighting is supplied from a brick power station, with a capacity for 700 Kw. for lighting and 800 Kw. for traction purposes. The equipment includes a new 300 Kw. Parson's steam turbine, and a new direct connected 500 Kw. railway generator. A brick repair shop, a car barn and several parcels of land in the city are owned by the company. The distributing system of the lighting plant is in excellent condition, having recently been overhauled and thoroughly rebuilt. The electric light franchise is perpetual, having been granted by special act of the legislature. The railway franchise expires in 1933. That part of the line running to the government military reservation is operated under authority granted by the Secretary of War, the grant on the naval reservation being by special act of Congress.

The salient fact about Pensacola is that it quite obviously has a future. Its development of the last thirty years can be regarded as hardly more than a beginning. Nature, in designing Pensacola harbor and in fixing the topography of the South Atlantic coast of North America, has designated the city as a highly important point of intersection in a great artery of trade. This fact is appreciated by the government of the United States, which is expending hundreds of thousands of dollars in improving the port as the naval base for the Panama Canal. If Pensacola is the natural base for naval operations in connection with the canal, it goes without saying that it must be the natural commercial base.



LIGHT VS. HEAVY CARS FOR STREET RAILWAY SERVICE

Philadelphia, Nov. 17, 1908.

Editor Stone & Webster Public Service Journal:—

In contributing the article under the above title in the October number of the Public Service Journal, Mr. L. H. Parker has made a notable addition to the literature on the subject. The various points are considered in a remarkably unbiased manner, and the article is a fine exposition of the care with which various types of equipment should be investigated before a standard is adopted. But unfortunately Mr. Parker has chosen an extreme case for his comparison, which gives a misleading impression from the start and results in a conclusion from which there is but one inference—namely, that a large proportion of electric railway officials have been unwise in adopting the semi-convertible car as a standard for their equipment.

In considering the subject, Mr. Parker chose for comparison semi-convertible cars which could be used all the year around, and which weighed “from 28 to 30 tons, light,” to represent the heavy equipment. For consideration as light cars, equipment was chosen which was at one time quite generally typical of the average road, i. e., “about a 25-ft. box car for winter and a 10 to 12-bench open car for summer service. These latter cars only weigh from 12 to 13 tons light.”

The weights for the semi-convertible cars are so notably extreme for the size car assumed, which will seat 52 passengers and stand an additional 48, that it is manifestly unfair to take them as a basis for comparison. In fact, the weight is so much above the average that it is almost possible to locate the cars which Mr. Parker has selected in gathering his data, and there is little hesitation in saying that they are, in all probability, cars for the Boston and Northern Street Railway, which were built at a time when there was a demand from that section of the country for extremely heavy and substantial cars. These cars weigh complete

with all equipment, when light, approximately 58,150 pounds, which is 14,000 pounds in excess of the average car of the same size built by The J. G. Brill Company. In fact, the average for a Brill 33 ft. 4 in. semi-convertible car (which corresponds closely to the size of the cars described by Mr. Parker) does not exceed 45,000 pounds complete with all equipment, and a car of this sort can be bought for \$6,000 instead of \$8,000, the price quoted by Mr. Parker.

With these figures as a basis, the aspect of the matter is entirely changed and the comparison takes the following form:

INVESTMENT.

Equipment consisting of 50 semi-convertible cars for all-year-around service. Each car seats 52 and can carry 100 with standing load.

Power station, 2500 Kw
@ \$150\$375,000

Car House, 30,000 sq. ft.
@ \$2.50 75,000

Cars: 50 semi-convertible cars completely equipped with 2 75 H-P, or 4 40 H-P motors, heaters, air brakes, etc. @ \$6000 300,000

Total\$750,000

YEARLY COST OF POWER, WAGES, MAINTENANCE, DEPRECIATION AND FIXED CHARGES.

Power cost, 7,300,000 Kw at cars & 1.5c per Kw\$109,500

Maintenance of cars and electrical equipment, 1,825,000 car ml. @ 1c... 18,250

Maintenance of power plant, 2500 Kw @ \$2.. 5,000

Wages: Conductors and motormen, 1,825,000 car ml. @ 4 1-2c..... 82,155

Depreciation: an average of 5 per cent. on all items of above investment 37,500

Fixed charges: 7 per cent. of investment..... 59,500

Total\$304,905

Difference 14,202

\$319,107

Equipment consisting of 50 summer open cars (12 bench) and 72 25-ft. body closed cars, seating 34 and carrying 70 passengers, including standing room.

Power station, 2000 Kw
@ \$150.....\$300,000

Car House, 30,000 sq. ft.
@ \$2.50 75,000

Car House, 25,000 sq. ft.
@ \$1.50..... 37,500

Cars: 50 12-bench open cars, each equipped with 2 30 H-P motors @ \$25,000 each 125,000
72 25-ft. body box cars, each equipped with 2 30 H-P motors @ \$3500. 252,000

Total\$789,500

Power cost, 4,790,625 Kw at cars @ 2c per Kw\$95,812

Maintenance of cars and elec. equipment, 1,916,250 car ml. @ 1.5c..... 28,743

Maintenance of power plant, 2000 Kw @ \$2.. 4,000

Wages: Conductors and motormen, 1,916,250 car ml. @ 5c..... 95,812

Depreciation: an average of 5 per cent. on all items of above investment 39,475

Fixed charges, 7 per cent. of investment..... 55,265

Total\$319,107

CONSUMPTION OF ENERGY:

Using Mr. Parker's figures for semi-convertible cars weighing 25 to 30 tons of 5 kilowatt hours per car mile, where stops average about four to five per mile and grades are few and light, it may be determined that the current consumption for cars weighing 44,000 to 45,000 pounds is not more than 4 kilowatt hours per car mile.

NUMBER OF CARS:

Cars of the same size as those considered by Mr. Parker are used in this comparison, hence no change is necessary from his figures which are:

Fifty semi-convertible cars for all-year-round service, seating 52 passengers and standing an additional load of approximately 100;

Seventy-two 25-ft. box cars seating about 34 passengers and accommodating a total load of approximately 70 passengers. The extra number of cars is required for handling rush hour traffic. For summer service, 50 12-bench open cars, which would be supplemented by some of the closed box cars when necessary.

MILEAGE:

The same mileage has been figured on which was employed as a basis by Mr. Parker: namely,

For the semi-convertible equipment 100 miles per day per car, or a total of 1,825,000 car miles per annum.

For the mixed box and open equipment a 5 per cent. increase to cover the increased number of cars in service during rush hours.

COST OF POWER:

At 4 Kw. per car mile for the semi-convertible equipment instead of 5 Kw., which is required for the heavy cars which Mr. Parker used as a basis, the total yearly output at the cars is reduced to 7,300,000 Kw. at the cars. At the same cost per Kw., 1.5c. at the cars, the total power cost is \$109,500 per annum.

The energy consumption for the mixed equipment is assumed the same as by Mr. Parker.

MAINTENANCE:

There is no apparent reason why Mr. Parker's figures in this connection should be changed from 1c. per car mile for the semi-convertible cars and 1.5c. for the mixed equipment. One cent per car mile is an ample maintenance charge for semi-convertible cars of the weight assumed.

CAPACITY AND MAINTENANCE OF POWER PLANT:

Though a power plant of slightly reduced capacity would be ample for the 45,000 pound capacity cars, Mr. Parker's figures of 2500 Kw. for the semi-convertible cars and 2000 Kw. for the mixed equipment have been allowed to stand as the rated capacity of the power station in both instances.

Maintenance charge of \$2.00 per Kw. is assumed correct.

WAGES:

No change from Mr. Parker's figure.

CAR HOUSE:

The same as assumed by Mr. Parker.

COST OF ROLLING STOCK:

The semi-convertible cars of the character assumed can be built for \$6000 completely equipped. The figures for the open cars and 25-ft. body box cars are approximately correct at \$2500 and \$3500 each, respectively.

DEPRECIATION:

An average of 5 per cent. as assumed by Mr. Parker.

FIXED CHARGES:

A total of 7 per cent in both instances.

CONCLUSIONS.

The difference in the cost of power, wages, maintenance, depreciation and fixed charges, as shown in the table, is found to be \$14,202 in favor of the semi-convertible equipment. Manifestly these figures must be more nearly correct than those advanced by Mr. Parker, or a large number of the electric railway managers have erred and erred badly.

In considering the figures, it is to be noted that the present showing has been arrived at without any consideration of a possible reduction in the power station investment, which, while slight, would make a reduction in the favor of the semi-convertible equipment amounting to several thousand dollars of investment, with the corresponding effect on the yearly costs. Nor has that intangible factor been considered which all managers know and appreciate, i. e., the attracting of maximum traffic. With semi-convertible cars there would not be the loss of traffic from the prospective passengers who would be repelled in summer by the necessity of riding in a closed box car or standing jammed in between the benches of the open cars.

Furthermore, no consideration has been taken in the figures of a somewhat unreasonable omission by Mr. Parker of air brakes from the closed box cars, whereas they are furnished with the semi-convertible cars. This would increase both the weight and cost of box cars. Heaters are apparently omitted also from the box cars with a corresponding decrease in capital cost.

Whatever the conclusions from the theoretical consideration of the matter, they are manifestly less satisfactory than an actual comparison of two very similar roads, operating under similar conditions with different equipment of the character outlined. But in the absence of opportunity for such a comparison, it would appear wise to defer to the judgment of a large proportion of the managers of electric railways of this country who have adopted semi-convertible cars as their standard after a consideration of all other forms of equipment and the factors involved in its operation.

And while it is undoubtedly necessary to study present practice in regard to rolling stock in a manner similar to that followed by Mr. Parker, with a view to improvement in the construction of the cars which are used, it is manifestly unfair to choose as a basis for consideration an example which is so exceptional as to represent only a very small percentage of standard practice.

W. H. HUELINGS, JR.,

Assistant Secretary, The J. G. Brill Company.

Boston, Mass., Nov. 20, 1908.

Editor, Public Service Journal:—

I have carefully looked over the foregoing criticism of my article on "Light vs. Heavy Cars for Street Railway Service" in the October number of the Public Service Journal.

I agree with the Brill Company in regard to the attractiveness of the semi-convertible cars during the winter season, because the passengers prefer the cross seats whereby they can face in the direction of motion. I still believe, however, that in the summer time the open cars are much more attractive to the riding public, providing the standing between benches is not allowed, which is generally the case in Boston and its vicinity.

The principal point made by the Brill Company is that I should have considered in my comparison car weight and first cost for the *average* size, instead of maximum size of semi-convertible cars. I agree with the Brill Company that the comparison of investment and yearly cost of power, wages, etc., would be more nearly

like the figures they give if semi-convertible cars weighing not over 45,000 lbs. (22.5 tons), completely equipped, are considered.

The Boston & Northern case alone was not used as a basis for my comparison, but I had in mind several city roads where semi-convertible cars weighing from 28 to 30 tons have been or are in use.

The purpose of my article was not to criticise the use of semi-convertible cars, but to show how expensive it is to operate such heavy cars for city service.

It would be interesting to know just what percentage of the semi-convertible cars which the Brill Company has sold for city service, weigh, fully equipped, 45,000 lbs. or less.

Yours very truly,

LEE H. PARKER.

A. W. HUNKING

At Helena, Montana, on Thursday, November 12, occurred the death of Mr. A. W. Hunking of the Stone & Webster Engineering Corporation. His illness began on the previous Sunday, but his condition excited no real apprehension until Wednesday. Though the time was too short for Mrs. Hunking to reach her husband from the East, his son, Mr. Sidney H. Hunking, who was engaged on the work at Hauser Lake, was, we are glad to note, able to be with his father during this period.

Mr. A. W. Hunking had been with the Engineering Corporation four years as hydraulic engineer, and had rendered services and formed associations of a character to make his loss keenly felt.

He was born in Haverhill, Mass., in 1851, his father being long identified with the boot and shoe manufacturing industry. He attended the public schools there, and on leaving the Haverhill high school went to the Massachusetts Institute of Technology, from which he was graduated at the age of nineteen. His first professional engagement was with Clemens Herschel, hydraulic and consulting engineer in Boston. From this position he went to the Locks and Canals Company of Lowell, Mass., for two years, and subsequently to the Holyoke Water Power Company of Holyoke, Mass., for a year or so. He then returned to Lowell, and was with the Locks and Canals Company for twelve or fourteen years. About 1890 or 1891 he identified himself with the Stillwell, Bierce & Smith-Vaile Company of Dayton, Ohio, for three years, his next engagement being with the Manufacturers' Mutual Fire Insurance Company of Philadelphia, where he remained for two years. About 1896 or 1897 he went South in the interest of the Massachusetts Cotton Mills Company of Lowell, Mass., and was for three years and a half located at Lindale, Ga. (just outside of Rome), building and operating cotton mill plants. From here he went to Huntsville, Ala., for the Merrimack Manufacturing Company of

Lowell, and for two years was occupied in building and operating a cotton mill. The next year or two Mr. Hunting did not devote very seriously to business, but about 1892 he was associated with Mr. Rice of Worcester, Mass., in connection with proposed western Massachusetts power development.

In 1905 he became identified with Stone & Webster. His first work in this connection was on the Taylors Falls development. Subsequently he was engaged on studies and surveys of the Chattahoochee River. Following this, he was for some time located at the Boston office of the Stone & Webster Engineering Corporation, going West last July in connection with the Hauser Lake work.

His wife and two children (Mr. Sidney H. Hunking and Miss Blanche B. Hunking) survive him. Mr. Hunking was a Knight Templar, and a member of the Montana Club of Helena, Montana, and of the Lowell Masonic Club.

STREET - RAILWAY TRANSPORTATION AS A CAREER FOR THE COLLEGE MAN*

By W. A. BANCROFT,

President of the Boston Elevated Railway Company.

The facts of the growth of urban transportation in this country and of the industries connected with, or more or less dependent upon it, are thoroughly impressive. Only a little more than fifty years ago the first commercially successful street-car line in New England was opened between Harvard Square in Cambridge and Bowdoin Square, Boston. Within the lifetime of men still in the service of transportation companies, every considerable city of the United States has witnessed the installation, first, of a system based on animal traction, and, afterwards supplanting this (except in a few instances, in which an intermediate cable installation took place), of a system of electric transportation, until now the street and electric railways of the country comprise more than twenty-five thousand miles of track, carry annually a total of fare passengers rapidly approaching ten billions, and give employment to an army of men more than twice the size of the regular standing army of the United States. In this development a wide area of allied interests has been affected. To furnish the equipment for hundreds of urban and interurban operating companies, vast manufacturing industries have been created out of hand. Important trade journals have come to represent exclusively the operation and equipment of street railways. An impetus has been gained that has not stopped with the confines of the United States. The skill and experience of American municipal transportation experts have been projected into every part of the earth.

A very important engineering science, in fact, has been created. Precisely as the hydraulic engineer focuses water supply upon desired destinations, as the gas engineer laying his intricate and far-reaching system of mains and smaller pipes foresees the needs

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of the community as regards illumination and heat, or as the telephone engineer arranges his network of wires to meet both present and prospective demands, for adequate service, so the rapid transit expert is an engineering specialist, prepared to project population quickly, comfortably, and safely from center to periphery of the metropolitan community and back again. His business is to study the natural topographical channels through which traffic flows, the psychological facts represented in changes of popular tastes and habits, the probable service requirements not only of today and tomorrow, but of the distant future, and, above all, to maintain the actual standard of service as closely as possible up to the theoretical conception.

Not only has this branch of engineering science been evolved within half a century, but it has not yet arrived at a static condition. Innovations and improvements occur year by year. Great developmental possibilities exist. Some of these are being realized experimentally in engineering laboratories and drafting rooms, others practically in the operating field by men who are in daily contact with the traveling public.

Street railroading offers, therefore, an attractive career to well-qualified young men. It is a business of distinctly professional character. It has prizes for ability and integrity. Nowhere else are ideas more in demand or executive capacity more adequately appreciated.

Just what circumstances a young college man who is attracted by the possibility of serving society as an urban transportation employee should take into account may be briefly indicated.

Regarding his personal fitness for the work, a young man should, needless to say, do some hard thinking. While brains are at a premium in street railroading, many personal qualifications enter into the making of a thoroughly competent man. No student can expect to succeed simply on account of high scholastic attainments. In some pursuits intellectual superiority is the factor that eliminates the individual from the mass. In the operating departments of a big street-railway system, physical robustness and staying power, such that the man can endure sustained and severe work, often under nerve-racking conditions; evenness of temper, such that he will get along well with his associates, whether his superiors or inferiors; soldierly bearing and regard for the cardinal principles of discipline; above all, plenty of common sense and that quality prized in old-time New England, everyday "gumption"—

these are essential parts of the makeup of the street-railway man who is destined to rise from an humble to an important position, and a young fellow who is conspicuously lacking in these characteristics would better try to get into some line of work where his limitations will be less of a liability than in a public service corporation. Book learning alone will not take him far.

The value, at the same time, of a man's having received during his college course adequate scholastic preparation for this kind of transportation work should not be understated. The leadership of highly educated men is demanded by present conditions. Most of the men who came to the front in the early days of the street-car business were not so strong on culture as on rough-and-ready efficiency. They were pioneers in a new region. They developed practices and systems by rule-of-thumb. They occasionally made mistakes which in the existing status of the science of transportation seem absurd, though these were thoroughly pardonable in the circumstances. They were on the whole successful in supplying something for which a public demand had arisen. Those with native capacity for progress acquired the science of the subject going along—always a slow and painful process.

Today, however, most of the results of their experience have been summarized in books and technical periodicals, so that the young man who, from preliminary training, is able readily to grasp with their applications the discussions of specialists, may learn in a brief time things which it took veterans of the service years to learn.

This point of the desirability of a broad, general preparation as preliminary to the special tasks that fall to the routine of employees of a street-railway company deserves emphasis. In order that a young man who finds employment in any given department may be ready to comprehend not only the practices which he finds prevailing there, but their reasonableness as well and their relation to the work of other departments, he would wisely lay out his course with a view to knowing thoroughly the main facts about the types of motive power and general equipment commonly used in street-railway construction and operation, the methods of financing, recording, and tabulating which public service companies of various types have developed in this country, and the general relations subsisting between corporations and the public, considered both historically and with regard to present circumstances.

The precise scheme of courses a student should lay out for

himself depends obviously upon the particular college catalogue from which he may choose his electives, the personalities of the men who give the courses, and, in the last analysis, on his own individual tastes and aspirations. If a young man's talents seems to run in mechanical directions, the emphasis in choosing studies should undoubtedly be laid on courses in physics, those particularly that deal with electrical theory and practice, and in engineering, with some special reference to the principles of railroad engineering. If, on the other hand, the student believes that he has already shown evidence of executive capacity and fitness to deal with the public, the larger share of his time might be devoted to courses in economics, such as those particularly in which problems of labor, corporation economy, and methods of financing are discussed.

In general, no one of these three elementary departments of training just mentioned should be neglected by any student who hopes to find a career in street-railway work. Closely specialized as are the activities in rapid transit companies of the great cities, a man who has been trained in one of them always stands a chance of rising to a position of general supervision. In particular, he may be called to the management of a company in one of the smaller cities, where he will require the ability not only to understand, but readily to execute, details of operation in all departments. There is a danger for the individual in some of our larger corporations, that he will specialize too closely. This danger is best anticipated if the college undergraduate so plans his course that if put at work in any capacity in connection with the operating of a street-car company he will not find that he has to learn a lot of elementary things about electricity, mechanics, and chemistry; that if required to make himself useful in the engineering department he will understand how to handle statistics, charts, and blue prints, and that if placed in a position where he must deal courteously and tactfully with the public and the press he will be familiar with the methods by which successful corporations avoid friction and convince the community that the service is worth what it costs.

This kind of academic preparation for the specific tasks that are best learned in the offices of the transportation company seem to me to be the all-essential thing. A student may, however, very properly select for his subjects for special reports and these topics that are directly connected with street-railway work. It would be easy almost offhand to name a hundred or five hundred themes for investigation, study of which would tend to familiarize the under-

graduate with some side of the business which he expects to enter. The recent success of Mr. A. E. Pinanski of the Harvard Law School, in winning with his thesis on "The Street-railway System of Metropolitan Boston" the Baldwin prize of \$100, offered by the National Municipal League for the best essay on municipal relations, illustrated the opportunities for special studies in this field of industry.

The question whether it is better for a young man who has completed the preparatory work here suggested to try to get a place with a street-railway company immediately after graduation or to go on into advanced work in courses specially devoted to the transportation industries,—as, for instance, in the new Harvard School of Commerce and Finance,—must, of course, be decided by the individual himself. For many men there is a considerable advantage in getting into the actual practical tasks of a business like that of urban transportation before they are too old to grow up with it. Others who have marked ability for research may find the loss of time involved in two or three years of graduate study more than compensated for by the grasp thereby gained on special and pressing problems of the business.

For those who go right to work, the familiar story of the necessity of beginning at the bottom must be retold. Even if it were possible for a young college graduate to start in a position of authority and responsibility,—it is impossible in any well-conducted street-car company, whatever the man's social or financial pull,—the individual would gain nothing from his temporary good fortune. He could not last long.

Those, for example, who expect to qualify in the operating department—and this in many respects affords the most promising field—should look for a chance to go on the platform of a trolley car with the expectation of staying there until proved capacity brings promotion. This is where the business is learned, not according to academic theories, but from the great book of human nature. The college-bred conductor or motorman comes into direct personal contact, under exceedingly democratic conditions, with the very men whom, if he proves to have chosen his calling wisely, he will later direct. He learns the irritations and temptations to which men operating the cars are subject; he comes to understand their point of view; he becomes personally acquainted with a large number of them, and he will never in later life make the mistake of regarding fellow-employees of the company as merely parts of a

great mechanism rather than as human beings, whose tastes, prejudices, and enthusiasms must be taken into account. Many other lessons he will learn as he operates his car, but this is most fundamental.

The methods of securing employment as conductor or motorman vary according to the locality. In some smaller companies it is mainly a matter of applying for a job and being looked over by the superintendent as regards probable fitness. In such an organization as the Boston Elevated Railway Company, it has been found necessary to establish a system of severe examinations, physical and mental, which a man must pass successfully before he can even be considered as a candidate for a place. This examination the college man will have to stand in competition with other well-set-up young fellows from city and country, many of whom come with references as good as his own, many of whom are as physically fit and mentally alert. Succeeding in the tests, he must await his turn for an appointment and must thereafter, as long as he is employed, live up to the rules and regulations which experience has imposed upon conductors and motormen as a necessity in protecting the lives of the public and the property of the company.

The compensation he will find good for the kind of work; but it is not, of course, such as permanently to satisfy an educated, ambitious man. If, therefore, the fellow has the stuff in him, he will exert himself to make such a record that promotion will inevitably come; and meantime he will all the while be quietly studying problems of rapid transit operation that lie outside of his own daily routine, so that when his chance comes he will be ready for it.

Many of the leaders in this new profession started at one end or another of the street car. The broadly trained young man who enters the service in the next few years may look forward to a career of great usefulness and satisfactory emolument.

The same generalization holds true as to employment in other departments of urban transportation companies. The man who enters an engineering department must expect to begin with tasks that seem humble and hardly worth while. The quality of his workmanship is, however, all the time under the inspection of his superiors. If he is uniformly accurate, painstaking, and thorough in the accomplishment of his tasks, his ultimate reward will be the reasonable one that is due to faithfulness and intelligence. If to these qualifications he adds imaginative foresight, so that he can take a commanding part in that planning for the needs of the

future which has become an increasingly essential feature of rapid transit engineering, he will become one of the leaders of his profession.

Far from discouraging applications for employment from well-educated young men, the average rapid transit company will be inclined in every way to encourage them, provided only that such applicants give themselves the benefit of preliminary training that will make them more adaptable to the work than uneducated young men of otherwise similar qualifications. The market for ability is wide open.

HOW TO PRESENT A GOOD CASE

The men of the Stone & Webster organization are important factors in a great many cities in the United States, both by reason of their personal value as citizens, and through their connection with that department of civic life which is always in the public eye—the administration of public utilities.

In no other business occupation can a young man take such an active part in the great sociological problems of the present day, and in no other way can he wield so much influence. But it takes young men of great mental capacity to grasp the fundamental idea, that the common ground on which the private investor and public patron meet is “as good service as will yield a fair profit,” and that neither of these factors can be swept away without injury to both. Except in rare instances it requires a trained mind to conceive large ideas. Common sense, so-called, is only an aid. Trained sense is necessary, just as it is to understand that wrapping ice in a blanket will keep it cool, a process directly opposed to common sense. The action of the mind must be trained by reflection, study, experience, school or college education, before it can appreciate that the same force that causes a stone to fall causes a balloon to rise, for common sense would deny it at once. That our young men have had this training is shown by their work. Their reflections are more than ordinarily keen and analytical, and their vision more than ordinarily broad. They are skilled in their respective departments and are hard workers.

This is the kind of material that has been used in setting up our organization, and so well balanced is it that if you go far wrong there is grinding and laboring of machinery until the matter is adjusted, but you may go right as vigorously as you please and never be checked.

Now we know all this, but do we always show it? If our equipment for our work renders us valuable to the community, our work is only half done until the community recognizes it and acquires confidence in us. It is not enough for us to know it, but

our directors and stockholders must know it, and it cannot be shown unless some thought is given to the methods of presenting our case. The fault of making rambling statements, both oral and written, is universal. Lack of order, completeness or definite aim, all arising from hurry, carelessness or affected style, are found in more than less letters, statements and reports; it is so common a fault that he who presents a case well is more highly considered than he who does the research and prepares it. Your reader or hearer has a given amount of mental capacity to devote to the consideration of your case and whatever he expends in understanding the situation and rearranging things in your presentation of the subject must be deducted from the total. In a badly presented case, instead of causing him immediately to weigh the subject you have forced him to use much of his energy in interpreting your work. If it is a matter of small interest to him, he never gets beyond the interpretation. If it is important, he wades through and comes out tired and irritated at the end. In any case, you have failed to make a favorable impression and gain any headway in his estimation.

Simplicity and directness of style is natural, but we all remember the florid sentences in our first business letters, which were brought about by a desire to impress the reader with our learning and experience, and which has its counterpart in many voluminous reports prepared with more thought of impressing the reader with the great mass of information contained than of bringing out the main points clearly.

The same method would be employed by your cook if she should furnish the ingredients and directions and ask you to bake your own pie. What you want is first a complete pie and you may then desire to know its composition for the purpose of renewing its acquaintance or avoiding it in the future. Of course, you must know the details and furnish them in explanation, but present the pie first and serve it in such a manner that the service will suggest a good pie.

The points to be brought out will vary with your audience and even the points themselves must be variously treated, but always with the idea of focusing attention upon the desired object while the mind is freshest.

"Cook with gas" is more effective than "We desire to sell you gas for cooking purposes and think you will be pleased with it from every standpoint."

A letter to the Boston office beginning: "We wish to say that we expect to reduce expenses in May in the following manner," will surely be read immediately. "It cost us more to pave last year than it did to run our cars" would rivet the attention of your alderman when tabulated figures would receive scant attention.

We do not advocate abruptness, but brevity is to be desired. In fact, for some branches of this matter we may almost use epigrams as in general conversation. To illustrate: In newer sections where other expenses are higher than the average and street railway fares and lighting rates are not, the general public does not realize that condition. A striking comparison is necessary to impress it upon them. If then everybody connected with the company should thoroughly realize and appreciate this situation, the idea would be spread quite rapidly, but it would go much more quickly if it was habitually expressed in a more or less picturesque manner. For example: "We charge eastern prices for our goods and pay western prices for our running expenses, and we are probably the only people in this city that do it." Even trainmen would grasp that idea at once and they are wonderful educators of the public if they believe in a thing. You will probably be astonished yourself at the number of illustrations of the above character that could be used to show that your company is doing its work well and cheaply. Find out what they are, frame up the proper way to express them and see that your whole organization believes it.

Any facts that are furnished the general public should nearly always be general facts, but to the authorities it may be necessary to be more specific. The method is the same, however. If you tell the mayor that "we put all our net profits and a million dollars of new money into extensions last year," it will interest him and he will remember it. You will be again astonished to see how many of these interesting facts can be brought out by a little examination. Always have as many of them ready as possible, but let them be strictly accurate.

In written communications it will be necessary to go more into details, but the method of presenting your communication has a great deal to do with the result. Begin with the summary and so arrange it that the mind naturally and easily follows the path arranged by you and verifies your results. As the best logic is simply a verification of one's experiences, so is the best business analysis one in which the details make it easy to verify the sum-

mary and difficult to do anything else. The same method holds good with communications to your superior officers and to your board of directors. Place yourself in the position of either of them and ask yourself the question as to what information you would desire under the same circumstances, that is, assuming you have no definite instructions. Then prepare your case so that what you think he wants to know impresses him first. If you have been associated with him or them, you will hit it right nine times out of ten and gain the reputation of having a remarkably clear head, and whatever reputation you gain your company gains, for whatever you and your associates do, the company does.

Stone & Webster's organization has a good case. Let us all see that we present it well.

ELECTRICAL INSPECTION AS THE CENTRAL STATION MANAGER SEES IT

By W. H. BLOOD, JR.

In the abstract, electrical inspection is highly desirable. The contractor, the consumer and the central station receive from an official inspection of electric wiring a certain satisfaction which cannot be obtained in any other way. The contractor is relieved of his responsibility as soon as he secures his certificate of approval, and is thereby enabled to get payment for the work which he has done. The consumer feels confident when the wiring has been inspected and passed upon that his installation is safe and that the requirements of both city and underwriting interests have been satisfied. The central station profits by the inspection, for it is in a way a guarantee that the wiring has been done properly, and, if a certificate is granted, that there is not much likelihood of a fire occurring through faulty wiring.

So far as the first two interests are concerned—the electrical contractor and the consumer—their assurances are likely to be made good. The central station, however, is not benefitted to the same extent. The fact that an underwriters', or even a municipal, inspector has looked over and passed upon the wiring of a property apparently does not, in the eyes of the court, relieve the electric lighting company from blame if injury occurs to persons or property caused by current coming in over the wires from the central station.

The National Electrical Code has no standing in court and is seldom admitted in evidence. Local city rules have but little more weight. The central station has always to prove that it has not been negligent—that it has taken every precaution known to the science.

*Read before the Western Association of Electrical Inspectors, October 21, 1908.

In other words, although it may be shown that an installation is made in conformity with the National Electrical Code, the rules of which, in general, are safe and satisfactory, and that the wiring has been done in accordance with city ordinances covering method of installation; nevertheless, in spite of both of these facts, if it can be proved that good engineering demands something else, then the electric lighting company may be held liable—in fact, has been in many court decisions. The central station, however, welcomes the inspection and believes, when it is carried on with intelligence and honesty, that all interested parties are benefitted thereby.

If electrical contractors were all honest, if electric lighting companies always guarded their customers' interests, and if consumers never meddled with wires, there would be little need of electrical inspectors; but, as neither electric light officials nor electrical contractors nor consumers are perfect and all are liable to be swayed by personal interests and individual prejudices, the inspector must remain, and he may become an important factor.

As soon as the inspector enters the field his personality and his peculiarities have to be taken into consideration. So long as there are laws or rules they will be interpreted differently by different individuals. Familiarity with the laws always helps in solving a difficulty. Broadness of interpretation is an indication of the intelligence of the inspector. It should not be necessary for the inspector to find fault with every installation in order to hold his job. Relegating to the background individual preferences is an indication of the bigness of an inspector. Only small men set themselves up as authorities.

You are all familiar with the little classic called "Pigs is Pigs," in which one Mike Flannery, agent for the Interurban Express Company, had a long drawn out discussion with a consignee and with various officials of the company with reference to the rate on guinea pigs. Mr. Morehouse, the consignee, insisted that the rate on pets was 25 cents each, while the agent claimed that guinea pigs were not pets but were pigs, and that the rate was 30 cents, and in the course of his discussion said,—“Whin the agint be in anny doubt regardin’ which of two rates applies to a shipmint, he shall charge the larger. The consign-ey may file a claim for the overcharge. In this case, Misther Morehouse, I be in doubt. Pets thim animals may be, an’ domestic they be, but pigs, I’m blame sure they do be, an’ me rule says plain as the nose on yer face, ‘Pigs, Franklin to Westcote, thirty cints each.’ An’ Misther Morehouse,

by me arithmetical knowledge two times thurty comes to sixty cints."

This did not seem to settle the matter in the mind of Mr. Morehouse and so Mike Flannery continued the argument. "Pigs is pigs," he declared firmly. "Guinea pigs, or dago pigs or Irish pigs is all the same to the Interurban Express Company an' to Mike Flannery. Th' nationality of the pig creates no differentiality in the rate, Misther Morehouse! 'Twould be the same was they Dutch pigs or Rooshun pigs." "Mike Flannery," he added, "is to tind to the expriss business an' not to hould conversation wid dago pigs in sivinteen languages fer to discover be they Chinese or Tipperary by birth an' nativity."

You will all remember that this controversy went on for days and weeks, and that before delivery could be made some \$64 had been spent for cabbages which had been bought to feed the increasing brood of pigs which had meanwhile multiplied from two to several hundred, and before the story ends to numbers which could not be counted. The final outcome of the story was that on a telegraphic order from headquarters the agent disposed of his pets, or his pigs, by shovelling them into bushel baskets and loading various box cars with them.

Mike Flannery was not an inspector, but his duties were somewhat similar. He had a book of rules to follow—a code if you please. Mike was not educated and he had no sense of discrimination. He was a small man. While he and the consignee were waiting for the rules to be interpreted by higher authority, his troubles and those of Mr. Morehouse were multiplying. Delays are often dangerous; they are generally costly as well.

Mike's greatest trouble was ignorance, or rather, unfamiliarity with his code. That is without doubt the greatest failing with electrical inspectors today—lack of knowledge of what the code contains. This fault, however, can be remedied; and if those who are inspectors would only realize this and would study their code, and if those who have the appointment of inspectors in charge would govern themselves accordingly, we should speedily bring about a vast improvement in inspections and a greater harmony in rulings.

An inspector should not receive his appointment until he has had several years of practical experience in electrical wiring, and then he should be required to pass a civil service examination, the questions being based upon the code.

The underwriters' inspectors are today largely taken from the above class, but, we regret to say, many of the municipal inspectors are not. Politics should not enter into these appointments, but too often it does. An electrical inspector, in fact any kind of an inspector, should be appointed from merit and not because of his "pull."

It is gratifying to state that "graft" is not a common fault among electrical inspectors. There are always black sheep in every fraternity, but an organization as a whole should not be condemned on that account. We hear from time to time unconfirmed stories of petty graft and of cases of intimidation and threats, but they are of rare occurrence. Although a few men here and there are known to be "crooked," we are confident that the very great majority of inspectors are honest, straightforward, and are doing the very best they know how.

This brings us to the question of fees, and, speaking frankly, I believe that any system of fees is wrong. The underwriters charge nothing in New England, while \$5 an installation is the rate in certain parts of Maryland. Municipal inspectors' charges vary in much the same manner. It would be an improvement if the charges were uniform; it would be still better if the charges were absorbed. It does not seem right that the users of the safest illuminant should be taxed when users of candles, kerosene and open flame gas with all the attendant chances for fire, are allowed to use these illuminants without inspection and subject to practically no restrictions. In some localities the inspector not only makes out the bill but collects the fee as well. This is not wise, for with such a system the honest inspector is open to criticism, and the dishonest one has an opportunity of which he is likely to take advantage.

And while on the subject of fees, one fee for one job should be sufficient. It irritates not alone the contractor and the electric lighting company, but the consumer, if an inspection fee is charged the first visit and a second and possibly a third one later on. Such a system as this tends not alone to make the inspector unpopular but also to discourage the use of electric light, which in turn hurts financially the electric lighting company, as well as the community, which would otherwise have a larger use of a more sanitary as well as a safer illuminant.

A not uncommon trouble is the fact that some inspectors are rather too egotistic. A little authority often makes a man officious.

A perfect inspector is hard to find, although we see one now and then who is pointed out as a model.

You remember the woman who was bragging that she had a "model" husband. A friend one day suggested that she look in the dictionary and see what the word "model" meant. She did so and this is the definition she found: "MODEL—A little imitation of the real thing." We do not need any model inspectors—we want the real thing.

The National Electrical Code is the standard book of wiring rules. The rules are not all perfect. The collection, however, is the best that we have, and it should be the only standard. It is the result of years of experience boiled down and put into workable shape. Additions have been made from year to year, and it is now like any code of laws that have been amended and amended, and which in the process has become clumsy and somewhat ambiguous. It is, however, in the process of being revised and simplified at the present time.

The underwriters believe in maintaining its integrity, and although one or two local boards have attempted to put in force supplemental rules, these have all been rescinded, and it is not likely, in view of instructions that have been sent from headquarters, that any more will be issued. Would that we could say as much for municipal rules. There are many city electricians or municipal inspectors who think that to make a name for themselves and to stand in with the city officials it is necessary to rush in and make "some necessary local rules." Many, in fact almost all, of these rules that are in force, are either whimsical or are already contained in some other form in the Code, and none of them add materially to the safety of the wiring. The only possible exception to this statement is that some municipalities have added rules which cover the life hazard, which the underwriters only indirectly cover. This procedure cannot, of course, be complained of.

A few cases have come to my attention in which underwriters' and municipal inspectors have joined together in an attempt to force the electric lighting company to undertake extensions or improvements which it could ill afford. For example: An underwriters' inspector visits a town and finds the outside wiring of the electric lighting company in rather poor condition, and he says to a municipal inspector, "Get up an underground ordinance and have it passed. It will help you with the city officials and will relieve me of lots of trouble." It should not be inferred that this exact con-

versation actually took place, but, as a matter of fact, the results as portrayed by it did. Such a procedure is taking an unfair advantage of the electric lighting company—it is passing sentence without hearing the other side of the case. Before attempting any such radical step the inspectors should talk the matter over with the local company, for if it can afford such a capital expenditure it generally makes it ahead of the demand from the inspector. Too many electric lighting companies are skating on such thin ice financially, that an ordinance forcing them underground is liable to bring about their destruction.

It should also be borne in mind that for all such expenses as this, for all unnecessary refinements and for all gilt-edged jobs, the customer, that is, the user of electricity, eventually pays the bill. He may not see it at first, but it is included in some way or another, possibly only in the inability of the company to reduce rates. The central station is not a creator of wealth; it only invests when the return is adequate. The customer always pays for refinements.

There are, we believe, only a few qualifications which are needed to make a satisfactory inspector, and these are not difficult of attainment.

First—He should have had enough practical experience to give him a good working knowledge to enable him to intelligently inspect all electric wiring installations.

Second—He should keep himself informed as to what the National Electrical Code is and what its rules require.

Third—He should not attempt to make changes in these rules nor additions to them.

Fourth—He should be honest in his interpretation and at the same time broad minded enough to know that his judgment is not infallible.

Fifth—He should co-operate with the officials of the electric lighting company in maintaining pleasant relations with its customers, and also with the local contractors in their efforts to maintain a high standard of wiring construction.

If the inspector comes up to these specifications there will be little to fear, for we can expect from such more fairly uniform interpretations and impartial and honest enforcements.

THE NEW 25 WATT ANCHORED FILAMENT TUNGSTEN LAMP

By N. T. WILCOX.

The advent of this new 20 candle power lamp is of more than usual importance, on account of its probable use in exchange for the 20 c. p., 50 watt carbon filament lamps now used. Due to its anchored form of construction, it is probably sturdy enough to allow of extensive use even in portables, as well as in other places where former fragility of this type of lamp forbade serious consideration.

During its life of 1000 hours, the new lamp will furnish a greater average candle power with a color value which is practically better in its effect on vision than the ordinary carbon filament lamp; but on the other hand, in many places, it will be desirable to use a frosted rather than a clear lamp, especially where the lamp is to come directly into the line of vision. In some cases, the effect may be bettered by using a six-inch straw-colored opal, enclosing globe or some equivalent device, especially where the lamp is to be used in fixture work.

Some of the larger central stations are selling these lamps to customers practically at cost. Cutting out the possible profit on the sale of lamps removes the incentive for supply men and irresponsible agents to unduly urge their use.

The great demand for this lamp will stimulate its production, but at the same time it does not seem that the factory facilities for the making of the small lamp can possibly meet the demand within two or three years. Meanwhile, the price will probably remain relatively high.

The general introduction of the new lamp will be largely affected by the policy of the central station manager. It would seem that the lamps would be most useful if sold to the customers at cost and furnished in a comparatively limited way to such customers as require them and are willing to purchase the lamps outright. This lamp will be largely useful to obtain competitive busi-

ness and to satisfy customers who have reason for objecting to their bills. Naturally customers will purchase these lamps to be used first in the long-hour locations with a corresponding effect on the bill, unless as a result of the cheapening of the illumination, the demand is broadened and hours of use extended.

Knowing the advantages and cost of the lamp to the customer, a few simple calculations will show the advisability of handling this new situation with care, not losing sight of the lack of wisdom which would be demonstrated by a narrow view of the situation.

The new 25 watt Tungsten lamp will be a first-class aid in broadening the use of electric light, but will necessitate a lot of careful planning and "hustling" by the central station manager if he is to record any immediate and material advances in income derived from the lighting department.

News from the Companies

BOSTON OFFICE.

After a stay of some length at the Boston Office, Mark Lowd, southwestern manager, returned to Dallas the last of October.

D. P. Robinson, president of the Engineering Corporation, and G. O. Muhlfeld, constructing manager, have been in the West since about the middle of October. Mr. Muhlfeld is in Helena attending to matters relating to the Hauser Lake Development.

F. N. Bushnell left Boston for a visit to the Puget Sound district in the latter part of October.

Walter Goodenough, of the Engineering Corporation, returned to Boston early in November after an extended stay in the South.

F. R. Coates and Lee H. Parker, of the Engineering Corporation, spent several days in Chicago early in November.

LOWELL, MASS.

Readers of the "Journal" may be interested in the Tungsten campaign which we now have well under way in Lowell.

Last spring we put out the first Tungstens, and now have something like 1200 units on our circuits, including those in our own office; 75 per cent of the lamps on the customers' circuits are either 100 or 60 lamps, put out at a net rental of 25 cents per lamp per month, this charge being additional to that for current.

Although we have a very aggressive gas competition, with 90 cent gas and all of the latest types of gas lamps placed on the customers' premises under the most favorable conditions as to the installation, we can report that about 40 per cent of the business we are now obtaining with the Tungstens is replacing gas, while probably of the remaining 60 per cent, 40 to 50 represents a broadened use of the customer's demand; so that on the whole, the improved service is bringing us new business and better satisfied customers, with some increase in the income account. This result has been accomplished during the dull times of the past few months, so that we feel encouraged to pursue this policy.

We have just introduced a window advertising lighting campaign on one of the secondary principal business streets of this city. The intention is to install a 100 watt Tungsten lamp with proper Holophane reflector in the merchants' windows only, and have the lamp turned on from sunset until 12 o'clock nightly. The hours of burning will be regulated by automatic time switches. This has been meeting with the approval of the merchants on the street which we have selected for the first installation of the lamps, and already over 200 lamps are in operation.

The stoker under No. 2 Stirling boiler in our new station has been put in operation, and is working satisfactorily at this writing. No. 1 boiler has been taken out of service and the work of installing stoker under this is progressing rapidly. We believe that this stoker will be in operation before the close of this month.

Our chief electrician, Mr. Percy J. Wilson, has just returned from quite an extensive wedding trip to New York, West Point, Atlantic City and Philadelphia. Mr. Wilson was married October 21, 1908, to Miss Stella Isabelle Wilson of this city.

BROCKTON, MASS.

The Edison Electric Illuminating Company of Brockton is about to furnish electric service in the town of Bridgewater, eight miles south of Brockton.

A new distributing system will be installed in the town, a high tension transmission line run from the Edison company's East Bridgewater power house and an up to date street lighting and twenty-four hour service put into operation.

On the refusal of the electrical contractors to sign contracts with the Electrical Worker's Union, agreeing to an advance of five cents per hour in the wages of the electrical workers, to take effect May 1st, 1909, the workers and helpers were called out on strike October 28th, but returned to work on November 9th, pending a settlement by mutual agreement between the contractors and the union.

The Plymouth County Gas Light and Power Company has just been incorporated under Massachusetts laws, with a capital of \$100,000. The company proposes to install a plant for supplying the towns of Rockland, Abington, Whitman and Weymouth with gas for illuminating and power purposes.

It is officered as follows:

President, P. J. Nevins, Haverhill, Mass.

Treasurer, T. A. Nevins, New York, N. Y.

Clerk, Jos. Nevins, Haverhill, Mass.

The above named, with John W. Murphy and William Fennessey, both of Haverhill, Mass., comprise the Board of Directors. Dollar gas is promised.

KEY WEST, FLA.

Hon. Peter O. Knight of Tampa arrived by the "Miami" on the 13th bringing with him Mr. Geo. J. Baldwin, president of the company, Mr. H. H. Hunt, district manager of the South-Eastern properties and Mr. F. J. Hovey of the Boston office.

Mr. Knight has many friends here and the hospitalities extended to these gentlemen will long be held in grateful remembrance.

Late in the evening the services of an excellent band were secured and a serenade charmed the visitors. Mr. Knight responded in a telling speech in which he clearly showed that the basis of our Constitution was the doctrine of personal liberty, so dear to the hearts of the citizens of this favored island.

TAMPA, FLA.

Tampa, Tampa, Typical, Tropical,
Always on Top-ical, T-A-M-P-A.

The above has been adopted by the Tampa Publicity Club, and appears on the stationery and all literature sent out by the club. It is the intention of the club soon to issue ten thousand booklets advertising Tampa and the immediate vicinity. Besides this, a number of small advertisements will be inserted in farm and other journals throughout the country, instructing those interested to communicate with the secretary of the club for specific information regarding the city. Six thousand dollars per year has already been pledged to carry on the work proposed by the club, and it is hoped to accomplish much for this section by this advertising campaign.

Simultaneously with the other properties under the Stone & Webster management, we have inaugurated a newspaper publicity advertising campaign for the purpose of preventing and avoiding accidents, this campaign being carried on just at this time by a series of articles published in the daily papers, calling the attention of the public to the carelessness incidental to getting on and off cars, and cautioning the general public to observe the usual precautions, and "Stop, Look and Listen" before attempting to cross street car tracks.

These articles are comprehensive, being clear and to the point, and are eliciting favorable comments from the public generally,

and it is hoped they will result in materially reducing the number of accidents, by reason of caution on the part both of the public and of our own employees.

Early in October the work of building the Tampa Northern railroad company's shops at Palmetto Beach was begun, and will be completed as rapidly as possible. The building itself will cost \$28,000, and will be equipped with the latest machinery used in repair shops of this kind, this machinery being now on the grounds.

Work on the terminals of this company is going ahead steadily, the dredging of the channel and filling in on the shore being completed, and the warehouses being in process of construction.

The Seaboard Air Line Railroads improvements in the same locality are also progressing satisfactorily. Orders for three million feet of lumber have been given for the bulkheading and other work being carried on by the Seaboard.

There was a most spectacular fire in the canal at Port Tampa recently, when the schooner "Wave", loaded with oil and gasoline, burned to the water's edge. Explosion followed explosion in quick succession, and for a time the warehouses, phosphate elevators and vessels in the vicinity were in grave danger, but through effective work, the fire was confined to the "Wave." Some of the oil in this cargo was consigned to the Key West Electric Company.

During the week ending October 17th the three box factories of the city manufactured more cigar boxes than at any time since last November. The Tampa Box Company is working both a day and a night force to fill its orders on time.

Four million nine hundred and five thousand cigars were shipped from the local factories during the week ending October 31st. The statement is now made that few, if any, of the good cigarmakers in the city are without employment at this time, and a few of the factories could use more men in making their holiday orders.

The annual state reunion of Confederate Veterans was held at Tampa during October, and the local representatives of the organization, having the entertainment of the visitors in charge, left nothing undone to make this occasion a memorable one. A pretty feature of the customary parade was the participation of seven hundred children from the local schools, whose lusty voices, waving flags and thorough enjoyment of their part in the program brought many smiles to the faces of veterans and spectators.

Mr. W. Goodenough of the Engineering Corporation, who

spent a week or ten days in Tampa recently, left for Boston November 5th. Mr. E. B. Powell of the Engineering Corporation also left November 5th for Savannah.

At this writing Mr. F. J. Hovey of the Boston office is paying Tampa a much-appreciated visit, stopping here on his way to Key West.

Mr. William B. Chapin, who several years ago was manager of the Tampa Company, accompanied by his wife, was a recent guest of our assistant manager, F. E. Fletcher, and was warmly greeted by his numerous friends in this city. Mr. Chapin is now a resident of Portland, Oregon.

PENSACOLA, FLA.

Pensacola exports for the month of October showed a big gain in valuation over the previous month's business. During the month shipments of lumber and timber increased to a considerable extent, while several cargoes of cotton cleared for foreign ports.

The third torpedo flotilla, composed of six torpedo boats, is again to have target practice in St. Joseph's Bay, making Pensacola its headquarters during the stay, which will be of several months duration.

Pensacola has just suffered the loss of one of her oldest and most esteemed citizens, Hon. W. E. Anderson, who died suddenly from heart trouble. He was three times mayor, in addition to serving the city and county in other official capacities. At the time of his death he was chairman of the board of equalization of city tax assessors and a member of the city school board.

Local automobile enthusiasts are contemplating for Thanksgiving day a race to Flomaton, Ala., a distance of 50 miles and return. To date there have been fifty or more entries, and no doubt the garages will work over time after the race.

Mr. F. J. Hovey, of the Boston office, is spending a few days in our city. Mr. Alba H. Warren, manager, has recently returned from Boston and other northern cities. Mr. Thomas J. Hanlon, Jr., of our transportation department, expects to visit his home in Boston during the Christmas holidays. Mr. H. H. Hunt, district manager, will be with us for a few days about December 1st.

BELLINGHAM, WASH.

I am forwarding you herewith cut of sprinkling car which was constructed in our shop and was productive of a very good revenue last summer, and which might prove interesting to some of the smaller Stone & Webster companies.



This car was constructed at a total cost of \$200.70, exclusive of trucks and motors, the trucks being Brill 21-E type, using two G. E. 67 motors. The length of body is 18 feet 9 inches, width 9 feet; tank is 6 feet 6 inches in diameter and 10 feet long, with a capacity of 2480 gallons. We found that we could fill the tank and discharge 9920 gallons of water on the streets in one hour.

The sprinkler is purely a gravity affair and is operated by quick opening valves, as shown in the cut.

The Young Men's Commercial Club raised a fund among the merchants to pay for the sprinkling of all the paved streets in the city and the water was furnished free by the city.

The total revenue in operating the car from May first to October first was \$1076.50; cost of operation, exclusive of power, during the same period, \$342.71; leaving a profit over and above cost of car and cost of operating during this period of \$533.09, and we now have the car paid for and ready for next year's operation, with an anticipated profit of approximately \$700.

We shall be glad to give further information to any of the Stone & Webster companies that may desire to go into the matter.

(L. H. Bean.)

Mr. L. H. Bean returned recently from a trip to Atlantic City where he attended the convention of the American Street & Inter-urban Railway Association.

Mr. Gardner Wells, who has been spending the last several months in Seattle, was in town a couple of days investigating accident conditions. He expressed himself as being very much pleased with the city and with this company's showing in his department.

(L. R. Coffin.)

PADUCAH, KENTUCKY

The Ohio valley has been suffering from the worst drought in thirty years. Practically all river craft have suspended operation, much to the detriment of business concerns accustomed to patronize the river transportation companies. The coal companies have been especially handicapped, and it is estimated that over \$6,000,000 invested in barges, steamers, etc., is lying idle on account of low water in the Ohio river.

The Fourteenth Annual Convention of the Ohio Valley Improvement Association met in Louisville, Kentucky, October 23-25. The object of this association is to secure for the Ohio river, through an act of Congress, an appropriation to construct a system of locks and dams between Pittsburgh, Pa., and Cairo, Ill. This

improvement is expected to provide a nine foot stage of water continuously between these points. The convention was unusually interesting, and enthusiastic addresses were made by Hon. J. E. Ramsdell, president of the National River and Harbors Congress, Major W. L. Sibert, of the engineering corps and member of the Panama Canal Commission, W. K. Kavanaugh, of St. Louis, Dr. W. J. McGee, Congressmen Swager Sherley, Walter Cox, Lincoln Dixon. Appropriate resolutions were adopted urging upon Congress the necessity of immediate action in the matter. This improvement will require about ten years to complete, and will cost \$63,000,000.

Manager F. E. Reidhead was among the Paducah delegates to this convention.

The city recently entertained a delegation from the Chicago Association of Commerce. A number of representative business men from Chicago, travelling on special train, have undertaken to visit neighboring and southern cities for the purpose of making new acquaintances and strengthening present business relations.

HOUGHTON COUNTY, MICH.

The first large snowstorm of this season struck the Copper Country on Monday, Nov. 9th, and by the middle of the week there was a depth of from 24 to 32 inches. Luckily, no high wind accompanied the snow, so that the work of keeping the railway open was not difficult. It was, however, necessary to put out the large plows in order to clear the Wolverine and Lake Linden extensions. It is the general opinion that this snow is the beginning of our seven months' winter siege.

During the past month, a contract was closed with the village of Hubbell by the lighting company to furnish electricity for the pumping of the city water. This water is drawn from ten wells driven on the lake shore. The wells are not artesian, and the suction will be from 12 to 18 inches. The reservoir to which water is pumped is approximately 200 feet above the lake surface. Two pumps, each of 100 gallons per minute capacity geared to 10 Hp., 220 volt, 2 phase motors, will be installed. The pumps are of the triplex, single acting, plunger type. The contract covers a period of five years, and payments, which are based on the quantity of water pumped, are as follows: 5 cents per 1000 gallons for the first one million gallons, 4.6 cents per 1000 gallons for the second one million gallons all over two million gallons to be at the rate of 4.2 cents.

The Tungsten lamp which we introduced into this district the first of the year has become of great importance to the lighting company. The company has been handling only the 100 Watt size. We have, however, quite a number of contractors, who are pushing the small sizes. It is astonishing to note the rapidity with which this lamp has been taken up by the people in general. Great numbers of the lamps, especially in the small sizes, have been placed in residences, stores and offices.

The heavy snowfall during the first part of November delayed the work on the Mohawk extension to a certain extent. Work cars are now able to run as far as the trestle that is being built at Mohawk, and it is planned that the passenger cars will be running on schedule by Nov. 25th. The ballasting of the road and the laying of the track is all completed. The overhead and bonding is rapidly nearing its finish. Practically, the only work remaining is the completion of the stations, a sub-station at Ahmeek, and a trestle at Mohawk, all of which are well under way. The extension, as a whole, is now in such condition that the snow will not materially interfere with work.

The production of the Lake Superior mines for the month of October was 19,943,340 pounds of fine copper. This is an increase of approximately 100,000 pounds over the same period in 1907. The total figures for the ten months ending October 30th show a decrease of 1,983,285 pounds from the same period in 1907, and a decrease of 545,000 pounds from 1906. This increase in production for the month of October unquestionably proves an improvement in the business conditions of this district.

The marine season on Portage Lake is drawing to a close, and Nov. 29th will again see us cut off from the outside world, so far as water routes are concerned. The light-house department is now removing all gas and can buoys in Lake Superior, these being replaced by plain spar buoys for the winter. The season on the lakes, as a whole, has been very poor. The Lake Superior & Ishpeming dock reports that from their docks this year were shipped 758,999 tons of iron ore, compared with 1,609,160 tons up to same date last season. This is a falling off of considerably over 50 per cent. The South Shore dock shipped 497,268 tons up to Nov. 1st, of this year. In 1907, 1,184,362 tons were shipped up to the same date. This same falling off is noticeable in all the other docks. The total amount up to Nov. 1, 1908, was approximately 22,000,000 tons, against 37,000,000 in 1907. This decrease in shipping has affected

business at all the lake ports, not only by decreasing the number of employees on the docks but also affecting hundreds of railroad men. Dock wages were somewhat lower than last year; the railroad men, however, have received the same wages. One of the large docks which was built in 1896, and which shipped nearly two million tons in 1905, reports that this is the poorest year in its history.

(P. A. Staples).

MINNEAPOLIS, MINN.

On November 9th, Mr. H. J. Gille, contract agent of this company, addressed a body of local business men on the subject of "Home Lighting". Mr. Gille's audience was much interested in the efforts being made by this organization to obtain for the public the best possible results. This address followed one on "The Business Qualifications of the Engineer" before the students of the University of Minnesota.

Mr. Wadsworth A. Williams, formerly advertising agent of this company, recently resigned to accept a position with a local implement manufacturing concern. Mr. Williams is to assume the position of state manager for the district of Nebraska.

During the past month several additional cables have been installed in the underground conduits, to enable us to carry the load over the peak of the winter months.

The 1300 horse-power triple expansion engine in our Main street generating station, which is being overhauled, will be ready for service on December 1st. The rebuilding of our Edison batteries at the Fifth street station will also be finished on that date.

For the purpose of better handling the important trouble calls during the day and the interruptions or troubles to the arc circuits by night, the operating department has purchased a high-wheeled buggy-type automobile. The engine is of 16 H. P. and of the two cylinder, double opposed, water cooled type. The wheels are 44 inches in diameter and are fitted with 1 1-4 inch hard rubber tires. A pivoted search-light in the front of the car aids greatly in locating line trouble at night. This car is to be used twenty-four hours a day and throughout the winter and summer. So far the car has given very satisfactory results.

While enroute to Helena, Montana, Messrs. D. P. Robinson, G. O. Muhlfeld and A. W. Hunking spent a few hours in Minneapolis.

(A. H. McGrath).

EL PASO, TEX.

On November 4th, 5th and 6th the combined race meet, and Os Aple Parade which culminated the festivities, formed the most

successful occasion of the kind that has ever been held in El Paso, encouraging the hope that in future years El Paso will always have a big race meeting during the fall, timed so as to get the horses going around the circuit on the way from Dallas to Phoenix. The meeting consisted of races on the first and third days and of a horse show on the second day. One of the most notable events of the race meet was the fact that Sonoma girl beat the State record for a half mile track, trotting a mile in 2.10 1-4. The Os Aple Parade, consisting of decorated vehicles and floats, both amusing and instructive, was held on the evening of the last day of the meet, and was the most successful performance of the kind ever occurring in El Paso.

The track work for an extension to the paving on El Paso Street in this city was recently finished. Bitulithic pavement is being used, the only kind that has ever been employed in El Paso. The track construction is of the most approved nature, consisting of 7 inch, 80 pound tee rail, embedded in a concrete monolyth 8 feet wide and 6 inches under the ties, and brought up to within two inches of the wearing surface of the street. Vitrified brick liners are used on the rails.

(C. W. Kellogg).

SEATTLE, WASH.

Mr. H. F. Grant, district manager, arrived in Seattle on October 29th, where he will make his headquarters during the next six or eight weeks while going over the affairs of the Northwestern properties. On the evening of Friday, October 30th, a reception was given in his honor by the transportation department at the trainmen's quarters at 5th and Pine streets. Some four hundred of the employees of the various departments of the company were present to extend their greetings to their former manager. A musical program, interspersed with short speeches by Mr. Grant and other officials of the company, made the meeting of unusual interest, and it was pronounced by all to be one of the most satisfactory and successful of the sort ever held. It is the intention of the employees to hold meetings of this nature at frequent intervals in the future, at which affairs of mutual interest will be discussed.

Mr. F. N. Bushnell, of the Stone & Webster Engineering Corporation, came out with Mr. Grant to look into the steam turbine question, and to investigate conditions generally in our various stations.

On October 1st the officials of The Seattle Electric Co. took

over the management of the Seattle-Everett Interurban Railway Co., which has been purchased by the Puget Sound International Railway & Power Co. This line extends north from Seattle about twelve miles, and it is expected that the line will be completed to Everett by July, 1909, in time to handle the Exposition traffic. This line passes through a good country, which is settling up rapidly, and will furnish a very considerable traffic as soon as completed to Everett. Though only running now into the country, with no terminal town, it is doing a very considerable passenger and freight business and paying its way. When completed through to Everett, the plan is to have this interurban line operate in connection with the Everett property, under the name of the Puget Sound International Railway & Power Co.

On Monday morning, November 2nd, regular operation was inaugurated over the new extension to Alki Point line, which has been completed. This line runs to South Alki, and affords transportation facilities to a large territory which has hitherto had to depend largely on boat service for its communication with the city. The ride is one of the most attractive in the entire city and a heavy patronage is expected.

A second shipment of twenty cars was received the latter part of October. A number of the first shipment of cars received a month or so ago have been placed in service. The advent of the additional cars will be welcomed by the traveling public, as traffic on many of the lines has been much congested.

The construction and engineering departments are very busy in connection with development and reconstruction work, made necessary by paving, regrades, etc., in various parts of the city, and work is progressing satisfactorily.

An issue of \$350,000 worth of bonds needed to complete the A. Y. P. Exposition arrangements was quickly taken up by local investors. This will enable the Exposition authorities to enlarge the scope of the fair, as the demand for space had exceeded the capacity of the buildings previously planned. An admission of ten cents is being charged at the gate, and every pleasant day hundreds of people visit the grounds, which are already taking attractive shape.

EVERETT, WASH.

A crew of Great Northern engineers recently began the survey of a branch line to extend from a point on that line about fifteen miles east of here into the Cherry and Snoqualmie valleys. This

branch if completed will tap one of the most extensive areas of heavy timber left uncut and will give a big impetus to the development of this section.

It was officially announced recently that the board of rivers and harbors engineers who visited the Sound a year ago has reported favorably on Major Chittenden's recommendation of the expenditure of \$279,000 on the improvement of the Snohomish river, having submitted a report to that effect to the war department.

The improvement of Snohomish River, referred to in the foregoing, means the deepening of the entrance of the river and of the river channel itself as far as Lowell, so that vessels may load direct from mills and wharves along its shores. It will double the size of the city's waterfront, causing Everett to lead every other city on the Sound in that respect. At the time the board of engineers visited the Sound a thorough inspection of Everett's river and harbor was made and the favorable report upon the project is the result.

What is believed to be a conservative estimate places the amount expended during the past year in Everett for building purposes at \$1,000,000. This estimate is made by a prominent architect and includes the construction of one large school house and one large apartment house. The bulk of the expenditure, however, went toward the building of homes. This architect is further quoted as saying that if the Everett-Seattle trolley line is completed in time two large apartment houses will be built before the middle of next year.

The lighting of Everett's principal thoroughfare by means of incandescent lamps continues to attract attention throughout the Northwest. The Tacoma News, commenting on the subject in a recent issue, said that "Everett has gained an enviable reputation as the best lighted city on the coast", and that Tacoma would do well to follow her example. The merchants of Spokane, it is stated, drawing their inspiration from Everett, will light Spokane's principal streets in a similar way. This plan of permanent street illumination was conceived in Everett and first put in operation October, 1905.

(Louis Lish).

SYDNEY, CAPE BRETON.

The outlook in the coal industry is not very promising for the coming winter. The Dominion Coal Company, our largest pro-

ducers, in this section, are reducing their operations to a considerable extent.

The prospects for the steel industry are much brighter than for some time past. The Dominion Iron & Steel Company have been able to secure some foreign orders for rails, which will keep their plant going for some time. There is also an increased demand for billets and rods.

Merchants report general trade conditions considerably below the corresponding month last year.

(A. F. Townsend).

PONCE, PORTO RICO.

As regards railway earnings, October has been a considerably better month than September, and the lighting department has done well. Conditions in general point to better business this winter. The cane is growing well, and even in the dryer districts the crop will be normal.

We have filed a proposition for a new contract for lighting the city of Ponce, but, due to the election excitement, the several bids have not yet been opened.

Today is election day and Ponce is very lively in consequence. The travel in the cars is very good. We have six cars on the line, making all trips double headers, and while they are not crowded they are carrying good loads. Both parties bought tickets for their constituents in the Playa, so that the conductors are not obliged to make change, as would be the case ordinarily. This helps in collecting on a crowded car, even though the public do complain that their pockets are not large enough to hold all the tickets.

Mr. Cooper returned last week from San Juan with his bride, and they are now living in the house of our postmaster on Villa Street. A reception was held there the night after their arrival and was, of course, a very enjoyable affair.

A lawn party was recently given on the grounds of the Methodist Episcopal church on Villa Street. The grounds were prettily lighted with strings of electric lamps and Chinese lanterns, and the tables were tastily arranged. As the party was in observance of Halloween, at the proper time the lights were turned out and the ghosts walked about the yard. To see jack 'o lanterns with apples roasting under the palm trees was rather unusual, but the ghosts fulfilled all the requirements of the story books, even to the extent of promptly disappearing when the lights were again turned on.

WOONSOCKET, R. I.

The company expects shortly to have completed its plans of the new offices for the combined gas and electric departments. Although at present nothing definite has been decided, it is believed that by the time of the next publication of the Public Service Journal definite plans will have been formed, and the work well advanced towards this change.

The work of the Engineering Corporation is rapidly shaping itself towards completion, so that we expect to have installed and in operation one (1) 375 Kw. and one (1) 170 Kw. A. C. 60 cycle generator on the first of December, at which time we shall begin the actual work of cutting over our present 133 cycle system to the new 60 cycle system. This, we feel confident, will be of mutual benefit, both to the company and to the patrons at large, as it will give them better, more uniform, and more reliable service than they have had in the past.

The work on the Franklin construction is progressing nicely. The transformers at this end are now installed and all that will remain after the installation of the generators is the completion of the Franklin sub-station, as the over-head line has been completed from Woonsocket to Franklin.

The various other jobs, such as changing over the steam connection to our Corliss engines, installation of an overhead coal and ash handling system, and several other minor items, have been completed.

During the past month we have made several changes in our organization, losing Mr. Thomas J. Walsh, who has been doing very good work while studying central station operation from the engine and boiler room standpoint.

Mr. Walsh was originally with the Boston office of the Engineering Corporation, performing the duties of assistant to Mr. Libbey. Believing that a more intimate understanding of the actual questions arising in the operation of a boiler and engine room of a public utility corporation would help him in his engineering work, he came to this company in May, and went to work in the engine room as oiler and general helper. The persistency with which he stuck to his work, and the record he has made, have won for him the good will and praise of all those who have come in contact with him, and while it is with regret that we lose him from our organization, we nevertheless wish him success in his new duties which he will take up shortly in the engine room of the Tampa Electric Company, in further pursuance of his studies.

Mr. J. V. Cullinane, formerly cashier of the Stoughton Gas and Electric Company, and the Electric Light and Power Company of Abington and Rockland, has entered our accounting department, where he will take up his duties as assistant to our assistant treasurer, Mr. C. H. Byrne. Mr. Cullinane has had considerable experience with Stone & Webster accounting methods, having worked in their employ for six or seven years.

The meter department has acquired the services of Mr. Warren Haskill, formerly of the meter department of the Boston Edison Company, and it is expected that his past experience with the Boston company will be of great value in systematizing our present meter department, and so placing it on a more efficient operating basis than it has been in the past.

The purchasing department has also met with a change, the duties being transferred to the assistant treasurer, Mr. Byrne, thus relieving the former purchasing agent, Mr. Parsons, who will now devote more of his energies to the development of the power business in this territory, which bids fair to be of considerable importance in the near future.

COUPONS AND DIVIDENDS DUE

	Per Cent
Dec. 1, Brockton & Plymouth Street Railway Company, First Mortgage 4½s, 1920.....	2¼
Dec. 1, Edison Electric Illuminating Co. of Brockton, First Mortgage 5s, 1930.....	2½
Dec. 1, Minneapolis General Electric Co., The, First Mort- gage 5s, 1934.....	2½
Dec. 1, Puget Sound Power Company, First Mortgage 5s, 1933	2½
Dec. 16, Minneapolis General Electric Co., The, Collateral Trust Coupon Notes 6s, 1908.....	3
Jan. 1, Cape Breton Electric Company, Ltd. 5s, 1932.....	2½
Jan. 1, El Paso Electric Company, 5s, 1932.....	2½
Jan. 1, Everett Water Company 5s, 1921.....	2½
Jan. 1, Houghton County Street Railway Co., The, 5s, 1920	2½
Jan. 1, Houghton County Electric Light Company, 5s, 1927	2½
Jan. 1, Lowell Electric Light Corporation, The, 5s, 1914....	2½
Jan. 1, Savannah Electric Company, 5s, 1952.....	2½
Jan. 1, Columbus Electric Company preferred stock 6 per cent	3
Jan. 1, Puget Sound Electric Railway preferred stock 6 per cent	3
Jan. 1, Electric Light & Power Company of Abington & Rockland, capital stock.....	4
Jan. 13, El Paso Electric Company, 6 per cent. preferred stock	3
Jan. 15, El Paso Electric Company coupon notes 6 per cent., 1913	3

QUOTATIONS

ON

SECURITIES OF PUBLIC SERVICE CORPORATIONS

UNDER THE MANAGEMENT OF

OUR ORGANIZATION

NOVEMBER 20, 1908

NOTE:—Quotations are approximate. Unless indicated to the contrary Bonds and Notes are 5 per cent and preferred stocks 6 per cent non-cumulative. Accrued interest should be added to quotations on Bonds and Notes.

COMPANY	BONDS	PREF.	COM
Blue Hill Street Railway Co., The	95	No pref.	....
Brockton & Plymouth St. Ry. Co.	93 ¹¹	No pref.	....
Cape Breton Electric Co., Ltd.	92½	75	17
Columbus Electric Co.	92½	....	....
Columbus Power Co., The	93 95 ^{Notes}	....	....
Dallas Electric Corporation	85 ^{7, 8}	45 ³	15
Edison Elec. Ill. Co. of Brockton	105½ 100 ^{Notes}	No pref.	170
Electric Light and Power Co. of Abington and Rockland	100	No pref.	162
El Paso Electric Co.	94 97½ ^{8 Notes}	85	41
Fall River Gas Works Co.	No bonds	No pref.	265
Galveston Electric Co.	92½	....	....
Galveston-Houston Elec. Co.	....	85 ¹	30
Houghton County Elec. Lt. Co.	95	22½ ⁶	14 ⁸
Houghton County St. Ry. Co., The	95	No pref.	No Com.
Houghton Co. Traction Co.	92	92½	20
Houston Electric Co.	97 ^{6, 7}	....	....
Jacksonville Electric Co.	97	96 ¹	80

COMPANY	BONDS	PREF.	COM.
Key West Electric Co., The	....	....	....
Lowell Elec. Lt. Corporation, The	100	No pref.	195
Minneapolis General Elec. Co., The	98½ Notes 100 ⁴	100 ^{1, 6}	85 ⁶
Northern Texas Electric Co.	100 ² Notes 100 ⁴	83 ⁷	85 ⁷
Pacific Coast Power Co.			75 ⁸
Paducah Traction & Lt. Co.	80	45 ^{1, 3}	15
Pensacola Electric Co.	92	75 ¹	20
Ponce Electric Co.	100 ⁴	No pref.	....
Puget Sound Electric Railway	98 ⁶ Notes, 1911 96 Notes, 1912 95	87	85
Puget Sound Power Co.	100	No pref.	....⁹
Savannah Electric Co.	80	45	12½ ^{6, 7}
Seattle Electric Co., The	1st m'tge 105 ^{6, 7, 8} Consol. and Refund m'tge convertible 100 " " " " non-con. 98 Notes 96¾	100 ^{6, 7, 8}	91 ^{6, 7, 8}
Tacoma Railway & Power Co.	98	No pref.	....¹⁰
Tampa Electric Co.	96	No pref.	110
Whatcom County Ry. & Lt. Co.	95	87½ ¹	38

1.—Cumulative. 2.—Bonds of Northern Texas Traction Co. 3.—5 per cent. 4.—6 per cent. 5.—Par \$25. 6.—Listed Boston. 7.—Listed Louisville. 8.—Listed Columbus, Ohio. 9.—Held by The Seattle Electric Co. 10.—Held by Puget Sound Elec. Ry. 11.—4¼ per cent.

STONE & WEBSTER

Boston - - - 147 Milk Street
Chicago, 604 First National Bank Bldg.

NOTE.—The Securities Department handles securities for those wishing to purchase or sell. Requests for information in regard to any of the above companies will be promptly answered at any time by this Department.

LIBRARY NOTES

Canada Year Book, 1907, recently issued by the Census & Statistics Office, Ottawa, Canada, is a handy source of reference for the general census data of the Dominion (taken every ten years—1901, 1891, etc.) and for annual statistics compiled from departmental reports, such as the returns on banks and banking, steam and electric railways, agricultural products and the like.

(G. W. Lee).

International Library of Technology, Volume 58, on Grammar, Punctuation and Letter Writing, is a very informative book, a careful perusal of which will brighten up old ideas and present many new ones pertinent to every day letter writing. A valuable acquisition to the Library. The division devoted to punctuation and capitalization is worthy of special attention.

(Alice G. Daly).

Statistics of Cities Having a Population of over 30,000 in 1906, Department of Commerce and Labor, Bureau of the Census—1908, is an analysis of the finances of 158 cities. Tables are given showing details of debts, receipts and expenditures and classifying them in a great variety of ways. Appendix A is a tabulation and analysis of municipal receipts from Public Service Corporations. Appendix B deals with the efforts to secure a uniform system of accounting for water supply systems.

(N. H. Daniels, Jr.)

"Continuous Current Engineering," by Alfred Hay, D.Sc. The author has picked out those basic parts of the subject which are of fundamental importance and treated them in an unusually clear and comprehensive manner. The student will find the book interesting and easy to read, and when he has mastered it will find that he is well grounded in the essential parts of the subject. The general subjects treated are: Electrical and Magnetic Units, Magnetism, Instruments, Dynamos and Motors, Storage Batteries, Lighting and Photometry, Switches, and Properties of Materials.

(I. A. Boyce).

"Reinforced Concrete Standards," by Andrews. A little book of about 50 pages, containing a large amount of information

useful to an engineer working in reinforced concrete. Proportions for beams and slabs are given in detail and in sufficient variety of spans and loadings to meet all ordinary conditions arising in practice. Reinforced footings for walls and columns are also considered and the theory of reinforced concrete beams touched upon. A valuable book for one having some prior knowledge of reinforced concrete theory.

(George A. Merrill).

The New Encyclopedia of Social Reform, containing over 1300 pages, can best be judged of by the reader's consulting it with reference to his own possible interests. Look, for instance, under Agriculture, Currency, the Galveston Idea, Lighting, Municipal Ownership, Profit-Sharing, Railways—in short, peruse this interesting book at your leisure moments and see if it includes “all social reform movements and activities, and the economic, industrial, and sociological facts and statistics of all countries and all social subjects.” On the title page is a profound list of contributors, from Upton Sinclair to Hon. Carroll D. Wright. See also the bulletin that supplements this, issued bi-monthly under the title of “Where is the Information?” It gives new books, articles and reports, aiming to be of practical help to all librarians and social investigators.

(G. W. Lee).

“Men of America,” containing nearly 2200 pages, issued in 1908, is a “bibliographical dictionary of contemporaries,” and will often be useful where “Who's Who in America” fails us. The entries are more lengthy than in the latter.

(G. W. Lee).

“Factory Management,” by Charles D. Cook, is an unpretentious but interesting and well indexed collection of manufacturing cost forms, etc., together with ample descriptive matter. This book is somewhat unique in its class, as the author sees his subject in good perspective, shows the result of co-operation among department heads, and also makes practical suggestions for securing such results.

(G. A. Cutter).

Robert N. Neilson's “Steam Turbine” has appeared in its fourth edition, and although descriptions of English and Continental plants predominate, the book is a very good one for those desiring to get an idea of the status of the steam turbine at the present time without going into the details of its design to any great extent.

(J. H. Libbey.)

LIBRARY

OF

STONE & WEBSTER

Current Literature

Selections from Recent Magazines and Book Accessions.

Ed, *, and + are used in cases of magazines to indicate editorial, illustration, and map or diagram respectively. But these symbols do not have the same significance in the case of book numbers, all of which are preceded by an asterisk.

Concrete.

- 1 Strength of rectangular beams: analysis for determining the resisting moment of a reinforced concrete beam; curves representing ratio of reinforcement; T-beams; location of neutral axis; explanation of T-beam table. Designing Methods-6|08-58-18.2p+
- 2 "Bridge number" of Concrete Rev, 10|1|08: descriptions of 13 concrete bridges; flattest, 3-hinged concrete bridge in world; Jamestown Exposition bridge; calculations and specifications for Philadelphia bridges, etc. Concrete Rev-10|1|08-16p

Electrical Engineering. (See also 20, 21, 27, 32, 39)

- 3 Alternating-current feeder regulators: methods of control; transformer; induction & automatic control types; methods of adjustment. WSMoody & dis. ProcAminstEl'lEgrs-11|08-1543-20p*+
- 4 Formulae & tables for the calculation of mutual and self-inductance. EBRosa & LCohen. BulBureauStds-8|08-6-127p+
- 5 Overhead constrn: line work & accessories; cross arms; spacing with pins; insulators; wires, weatherproof & bare; grounding the secondary; arrangement of wires on bldgs; arc circuits; joint poles. HBGear. El'lAge-10|08-229-7.3p*+
- 6 Most important hydro-el installation in Europe: equipmt of Brusio plt of "Societa Lombarda;" transformers; devices for ltng protection; lines of sub-station at Lomazzo & other features; the terminal station at Castellanza. EnricoBignami. Eng'Mag-11|08-179-20.8p*+

Boilers and Engines. (See also —)

- 7 Notes concerning the selection of stm boilers & the design of boiler rooms: commel efficiency; fuel; location; water space; grate surface; piping; feed line; coal storage; chimney & economizers. WBGump. JrnlEl'yPr&Gas-10|31|08-275-3p+
- 8 Low pressure stm turbine: stm energy available through expansion; rept on economic possibilities of a stm turbine by ProfIraNHolls. ChasBBurleigh. GenElRev-11|08-225-10p+

Railway Affairs. (See also 22, 40)

- 9 Overhead line constrn & maintenance: Boston; Los Angeles; Phila; Minneapolls; interurban line constrn; NY,NH&Hartford etc; trolley wires, tower cars & wagons; catenary constrn. ElRy Jrnl(Sup)110|10|08-853-12.2p*+
- 10 Education & training of employees is treated at length in Elec TractnWkly, 10|31|08. Instructions for motormen and examination on city rules by the Syracuse Rapid Transit Co; summary of this subject as presented at the Atlantic City meetings. ElTractn Wkly-10|31|08-26p
- 11 Employment of trainmen: requirements, tests & forms of application blanks; methods of instruction & discipline; merit & demerit systems of various el ry cos. ElRyJrnl(Sup)-10|10|08-784-14.1p*+

Accounting, Finance, etc.

- 12 Savings banks in US: with map & table showing the no, character, synopsis of investments, etc for each state in the Union. WH KniffinJr. Bankers'Mag-10|08-507-8.9p+
- 13 Interstate Com Commsn classification of accts for el roads: operating expenses; form of order. ElRyJrnl-10|17|08-1222-2.2p+
- 14 Fair rates for pub service: Maine opinions; Heath's method of rating & valuation; rate of interest & base on which it is to be calculated; reasonable profit allowance. Abs, Leonard Metcalf, (Proc'dgs Am Soc Civ Egrs, 10|08). Eng'gRecord-11|7|08-530-1.7p

Book Accessions.

- 15 Specifications for bridges carrying el rys; adopted by Mass R R Commsn. Revised Aug 1908. 26p, 6x9 (1908). *0734.M38
- 16 Primer of conservation: White House conference of governors; President's letter appointing National Conservation Commsn; membership of commsn. Treadwell ClevelandJr. US Forest Service, Cir No 157. 24p, 6x9, 1908. *6882.C157
- 17 Bldg ordinance of City of Cambridge, Mass. Approved 1|2|08, in effect 3|1|08. 71p, 4½x7¼, 1908. *1445.03
- 18 Preservative treatment of loblolly pine cross-arms. WFSherfesees. US Forest Service, Cir No 151. 29p, 6x9, illus, 1908. *6882.C151
- 19 Preliminary rept on ground waters of San Joaquin Valley, Cal: geography, soil & agricultural importance; wells & pumping plants. WalterCMendenhall. US Geol Surv, Water-Supply Paper No 222. 52p, 6x9, map, 1908.
- 20 Theory & calculation of a-c phenomena. CharlesProteusSteinmetz. Ed4, 746p, 6½x9½, illus, 1908. *071.St3.1
- 21 El'l energy: its generation, transmsn & utilization; transmission line; line constants, power station, prime movers; generators, alternators, transformers, pr factor etc. Lectures given at Union University by ErnestJuliusBerg. 184p, 6x9½, illus, 1908. *071.B45
- 22 Stm pr plt engineering: fuel; boilers; steam; coal handling; chimneys; steam engines; turbines; condensers; feed-water; pumps; piping; lubrication; finance & economics; specifications; typical stations: GFGebhardt. 816p, 6x9¼, illus, 1908. *072.G26
- 23 Elements of ry economics: a discussion of ry expenditure & income. WMAcworth. 159p, 5x7½, 1905. *022.Ac9
- 24 St ry system of Metropolitan Boston: history of Boston st rys; franchises; present conditions; suggested improvements. William HBaldwin Prize Essay, AEPinanski. 58p, 6x9, 1908. *1461.022.P65
- 25 Statistics of cities having a pop of over 30,000, 1906: private & government accounting; accounting terminology; municipal receipts & expenses; municipal water-works; city finances; municipal receipts from public service corporations; uniform accounts

- for water-supply systems. Bur of Census, Dept Com & Labor, 1908. 350p, 9x12. *6891.C49.2.1906
- 26 Raymer's dictionary of Greater Seattle: an encyclopaedic-dictionary of State of Wash in gen & City of Seattle in particular. ChasD Raymer. 128p, 5x6½, illus, map, 1907-08. *6131.0651
 - 27 Rept of Mass Board of Gas & El Lt Commsnrs on petition of Public Franchise League relative to prices & system of charging by Edison Electric Illuminating Co of Boston, 5/29/08: fixed & running costs & diversity factor; the demand system; individual costs not accurately ascertainable; extent to which differential rates are justifiable. 31p, 6x9, 1908. *1407.Ed4
 - 28 Classification of expenditures for road & equipmt of el rys as prescribed by Interstate Com Commsn in accordance with Section 20 of the Act to regulate commerce. First issue. 20p, 6x9, 1908. *6803.Ce56.2v
 - 29 Classification of operating expenses of el rys as prescribed by Interstate Com Commsn in accordance with Section 20 of the Act to regulate commerce. First issue. 47p, 6x9, 1908. *6803.Ce56v
 - 30 Classification of operating revenues of el rys as prescribed by Interstate Com Commsn in accordance with Section 20 of the Act to regulate commerce. First issue. 15p, 6x9, 1908. *6803.Ce56.1v
 - 31 31st an rept Dept of Geology & Natural Resources. Indiana 1906: peat; petroleum; natural gas etc. WSBlatchley. 772p, 6x9, illus, maps, 1907. *2601.1906
 - 32 11th an rept Dept of El'y, City of Chicago, 1907: statistics and cost of street lighting; cost of maintaining municipal lighting system; fire alarm; inspection etc. 104p, 6x9, *2731.El2.1907
 - 33 Franchise ordinances of City of Dallas. ChasT Morris. 1908. 315p, 6x9, 1908. *+5222.0312
 - 34 R R Commsn of Wis. Chapter 362, Laws of Wis for 1905 as amended * * * also other laws affecting rys passed by the Legislature of 1907: Act creating the railroad commsn. 99p, 6x9, 1907. *2804.031
 - 35 List of defunct mun ltg plts. Compiled by ArthurHastingsGrant. Published by M O Publishing Bureau. Ed4, 38p, 6x9, nd. *029.G76a
 - 36 Chicago City Manual: containing list of executive & other city officers; lists of aldermen etc; mileage & equipment of city rys; franchise provisions. City Statistician. 203p, 6x9½, illus, 1908. *2731.St2
 - 37 Index map & st directory of Boston, Brookline & Cambridge, 1908. Sampson & Murdock Co. 24p, 5x9, map 30x35 (Scale 1 inch = 1500 feet). *1461.0612
 - 38 Men of America: a biographical dictionary of contemporaries. Ed by JohnWLeonard. 2188p, 6½x8¾, nd. *092.L55
 - 39 Western El'l & Gas Directory: el pr, ry & lt cos, gas cos, engrs, contractors, dealers, etc in Arizona, Cal, Nev, Or & Wash: list of members Pacific Northwestern Society of Engineers, Am Inst El'l Engineers; Pacific Coast Gas Association. Blanchfield Pub Co. 224p, 5x8. 1908. *.093.B59
 - 40 Stm turbine. RobertMNeilson. 4th ed, 604p, 6x9, illus, 1908. *723.N31

